Existing Trailside Museum Lecture Wing from Canton Avenue (Pressley Associates 2007).

4. Recommendations

This chapter presents and describes the recommended site and building plans for Trailside, and includes a discussion of recommendations related to indoor and outdoor exhibits, drainage and stormwater management, construction phasing, permitting and approvals, preliminary cost estimate, operations and management, maintenance, and additional planning studies and design, all of which are necessary to fully achieve the objectives outlined in this Master Plan. The proposed Site Plan and building Floor Plans are included as fold-outs at the end of this chapter. The narrative descriptions included here are intended to provide a verbal description and explanation of the plans and inform subsequent design phases.

Preferred Alternative

Based on an evaluation of the alternatives, the project team selected Alternative #3 as the preferred alternative – a new nature education center located east of (above) the pond with primary access from the north parking lot. In a slightly improved form, this preliminary plan was discussed with the Trailside Advisory Committee on May 7, 2008 (see Appendix E), who provided comments and suggestions for improving the plan. These comments, along with additional input from DCR and MAS are reflected in the final Recommended Plan, which is summarized below.

Recommended Plan

Overview

The recommended design for the new Trailside nature education center provides an efficient and functional distribution of the building program in a sustainable design plan that is integrated with site circulation and topography. The selected site slopes down from east to west, so that the new building will have two stories at the west (entry) side facing the pond, and one story at the uphill (east) side. Visitors will use new vertical circulation inside and outside the building to make the transition to the outdoor exhibits and to the hiking trails, respectively. The building's lower (entry) level includes the "free" public areas, such as the Orientation Center (lobby), a few exhibits and the Gift Shop, as well as staff-only areas such as Animal Care and the Wood Shop, which are served by a staff entrance. At the upper level are the "paid" public areas such as the Lecture Hall

and exhibits, and also staff administrative offices. The interior stair, which transitions between the "free" information/Orientation Center and the "paid" exhibit area provides a conceptual representation of Great Blue Hill, with opportunities for interpretive exhibits incorporated into the stair. A live animal exhibit – for snakes – is visible from the stair and Orientation Center. Building materials can include local or regional wood and stone (note that it is small enough in area to have a wood structure, according to the Building Code), and the majority of program spaces will have windows, allowing natural ventilation, daylighting and views to the site.

The site plan emphasizes improved vehicular and pedestrian circulation for Trailside and trail users as well as shared winter use by the Blue Hills Ski Area. The north parking lot will become the primary parking and vehicular drop off for the nature education center, thus achieving a separate identity for Trailside. Both lots can be flexibly used by hikers, with the south lot re-configured to better accommodate winter ski use. However, these lots can be flexibly used for access to the Trailside nature education center as pedestrian paths connect both parking lots to the building along an elevated boardwalk around the pond, which is now free and open to all. The outdoor animal exhibits are accessed through the nature center, and feature amphibians, birds and mammals native to the Blue Hills and which currently are exhibited at Trailside, with a designated expansion area for future exhibit development. The animal enclosures are roughly grouped following a series of native habitats (wetlands, forest, fields, and rocky outcrop), with accompanying plant community exhibits incorporated into the enclosure area. Both the interior and exterior exhibits emphasize the geology, plant communities, cultural history, habitats and animal species native to the Blue Hills, with opportunities for the presentation of "hot topics" current to the Reservation. Outdoor program spaces are provided in two areas: an outdoor Amphitheater transitions up the slope at the north end of the new building with easy access to trails, and a second program/picnic area is located in the animal exhibit area. Trails can be easily accessed both from the south parking (Red Dot Trailhead) as well as the north parking lot and outdoor gathering area.

Site

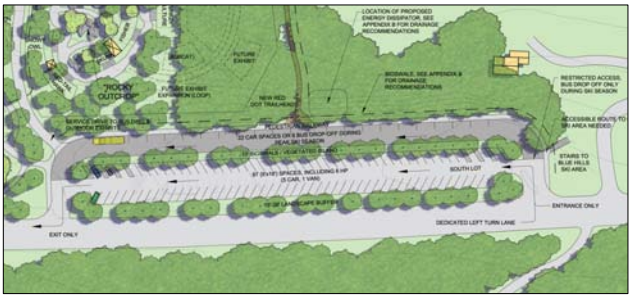
Vehicular circulation and parking

The Recommended Site Plan retains both the north and south parking lots, but greatly improves vehicular circulation in general by facilitating joint use by Trailside, hikers and the Blue Hills Ski Area, and increasing vehicular safety, and reducing the overall impermeable paved surface. While both parking areas can be flexibly used by Trailside visitors, skiers, hikers, and other visitors to the Reservation, this plan is designed so that the north lot is the primary Trailside parking. The total parking capacity is now 202 parking spaces (119 in south lot, 83 in north lot). Although this is a slight reduction from the existing 208 striped spaces (103 in south lot, 105 in north lot), the majority of the existing spaces are substandard in size with some inaccessible so that in reality, the existing capacity is far below 208 spaces, particularly in winter.

The north lot is entered from the south end, with bus drop-off and proposed public bus stop along the entrance at the north side of the pond. Buses can circulate along the outside of the parking lot and exit heading north onto Canton Avenue/Rte. 138. A dedicated left-turn lane is recommended to provide for a safe left turn for travelers heading south on Rte. 138, but this recommendation requires additional traffic study and approval by the Massachusetts Highway Department. Five (5) accessible parking spaces are provided in this lot, with a total of 83 parking spaces. The lot is broken into two parking areas, separated by vegetated island or bioswale. The lot has also been designed to respect the 25' no-build zone along the existing outlet from the pond.

Proposed new layout for north parking lot showing pedestrian access to the new building (see Recommended Site Plan for relative scale, Pressley Associates

The south lot is intended to be flexibly used by multiple users. The entrance is one-way, from the south with two separate parking areas aligned roughly parallel to Rte. 138 and the hillside. The easternmost parking area consists of a single travel lane with 22 parallel spaces along a new pedestrian walkway, which can be effectively used exclusively for bus drop-off during winter ski season. The western section of parking spaces includes a total of 97 parking spaces including three (3) accessible spaces that can be used year-round, with three (3) additional accessible spaces located close to the ski area. Both parking areas in the south lot are separated by a vegetated island or bioswale as in the north parking lot.



Proposed new layout of south parking lot (see Recommended Site Plan for relative scale, Pressley Associates).

Service

A single vehicular service road connects the building to the south parking lot, as the maintenance garage is now incorporated into the nature education center. Vehicular service into the outdoor animal enclosures is through a gate in the perimeter fence, opposite the garage.

Pedestrian circulation

Building entrance

From the north parking lot, visitors to the new nature education center walk up a gently sloping path, past the Canton Ave. Restroom, to the outdoor gathering area overlooking the pond. Visitors parking in the south lot can easily reach the building by following the path or raised boardwalk around the pond.

Educational exhibit paths and circulation areas

A raised boardwalk with railings borders the east and north side of the pond. This boardwalk is intended to provide an accessible route around the pond, but is raised above the water and wetland vegetation with a railing to protect the site from inappropriate access and use (see illustration at right). The perimeter should be heavily planted with woody wetland vegetation on the outside to further discourage unauthorized access. This boardwalk is proposed to be open and free to all visitors. A low fence could be considered later if necessary for additional site protection.

The zoological exhibit area, which is proposed as a paid venue, is accessed through the building, with an irregular loop around which the animal enclosures are located. This pathway will be fully accessible, with landscaped areas constructed of natural materials such as stone and native plants to further illustrate the plant communities of the Blue Hills Reservation. A second exhibit loop is shown on the Recommended Site Plan, as a potential area for expansion.

Example of a raised boardwalk with railings, Sabal Palm Audubon Sanctuary (photo by Keith Hackland).

Hiking trails

Both the lower section of the Red Dot Trail and the trailhead at the south parking lot have been relocated to provide additional space and buffer for the outdoor animal enclosures. This new alignment equalizes access from both parking lots to the Reservation's most popular trail, and it allows for better drainage and control of severe erosion down the face of the hillside. It is also closer to the original location of the Red Dot trailhead and restores the historic tie to Trailside that was lost with the addition of the USDA perimeter fence.

Other changes to the existing hiking trails include improvements to provide clearer connection to the Wolcott Path from the north parking lot, and a major trailhead connection with kiosk at the north end of the building. This trailhead allows direct access to the trail system both for visitors to the nature education center and individuals parking in the north lot, with additional opportunities for information and orientation at the northwest corner of the building, where exhibits and a window into the gift shop could provide trail maps, etc. to hikers.

The serpentine trail through the Cleveland Natural History Museum Wildlife Center helps visitors attain a feeling of being immersed in the natural environment. There are moments where the building and enclosures are lost among the vegetation (objectIDEA).

Outdoor gathering areas

The Recommended Site Plan includes several areas that provide places to gather and orient, as Trailside is frequently visited by large groups:

- The front of the building includes a large paved outdoor gathering area overlooking the pond that melds the architecture into the landscape, serving as the first orientation area for visitors to the new nature center building.

- An outdoor Amphitheater is recommended, built into the hillside. It can be used by both DCR and MAS and is integrated into both the trail system connections and the nature education center. As shown on the Recommended Site Plan, the Amphitheater could accommodate up to 100 people. As the design develops, a fire ring might be also be integrated into the Amphitheater.

- Inside the zoological exhibit area, a picnic area/program space provides a dedicated gathering area for organized groups or casual visitors. This area can support approximately one classroom (e.g. 30-35 people), especially when multi-classroom school programs necessitate splitting large groups into smaller units, or when school groups need a safe and enclosed area for lunch.

Building

The design of the new Trailside nature education center can be described by the way it relates to its site, serves visitors and staff, and demonstrates environmental responsibility (see illustrations at the end of the Chapter: Recommended Site Plan and Floor Plans).

Relationship to Site

The preferred site for the building is at the east (uphill) side of the pond, set back from the road and connected to the two parking lots by walking paths. Where the existing Museum building had a farmhouse character and stood in a meadow close to the road, this new building can fit into its natural wooded environment without domesticating it, in coordination with the Trailside's goals for environmental education and stewardship. The site slopes down from east to west towards the pond, and the building is oriented to fit the contours of the landscape as a long rectangle. It will appear as a two-story building when seen from the road or across the pond, and as a one-story building when seen from the hiking trails or from the outdoor exhibit areas. Nestled into the slope of a hill, the building itself will embody upward travel as it invites visitors to move upward and inward towards exhibits, program areas or recreation trails.

Visitors and Staff

Trailside visitors, including school groups, can assemble at the outdoor gathering or indoor Orientation Center, at the entry level. They will encounter an information desk, where they can pay entrance fees, and then proceed up the main stair to the upper level, passing by nature exhibits installed along the stair and in the lobbies. At the upper level they can proceed to one of four areas: Exhibit Hall, Lecture Hall, Classroom, or outdoor exhibits. These areas are separate from one another and thus can accommodate several groups at the same time, or the scheduling of staggered groups using the areas in the same sequence. Public toilets are also provided within the "paid" area at the upper level. On completion of their visit, visitors return down the main stair, exit to the "free" Orientation Center, and visit the Gift Shop on their way out.

Hikers and other recreational visitors can visit the building and find information about the Blue Hills Reservation. The Orientation Center, at the entry level, is open to the public free of charge, and offers maps and weather information, some free nature exhibits, a view into the animal care area, public toilets, and information from the staff member at the desk. While stopping in for a map or refreshments from the gift shop, a hiker can see some of what Trailside has to offer and consider coming back for a visit.

Events participants will use the building for off-hours occasions combining education, exhibits and socializing, when it is otherwise closed to the public. These events will use some or all of the upper-level "paid" areas: exhibit, lecture and classroom spaces, as well as the public circulation spaces (lobbies and stairs) at both levels. Refreshments can be prepared at the upper-level kitchen.

Trailside staff will work in several different areas of the building. The Orientation Center and Gift Shop will have staff working at service counters in public areas; the offices suite at the upper level will accommodate the administrative personnel; Animal Care and Animal Quarantine at the lower level are work areas for two categories of animals under care in the building; the Wood Shop, mechanical and other service areas at the lower level are work areas for building operations, maintenance and construction.

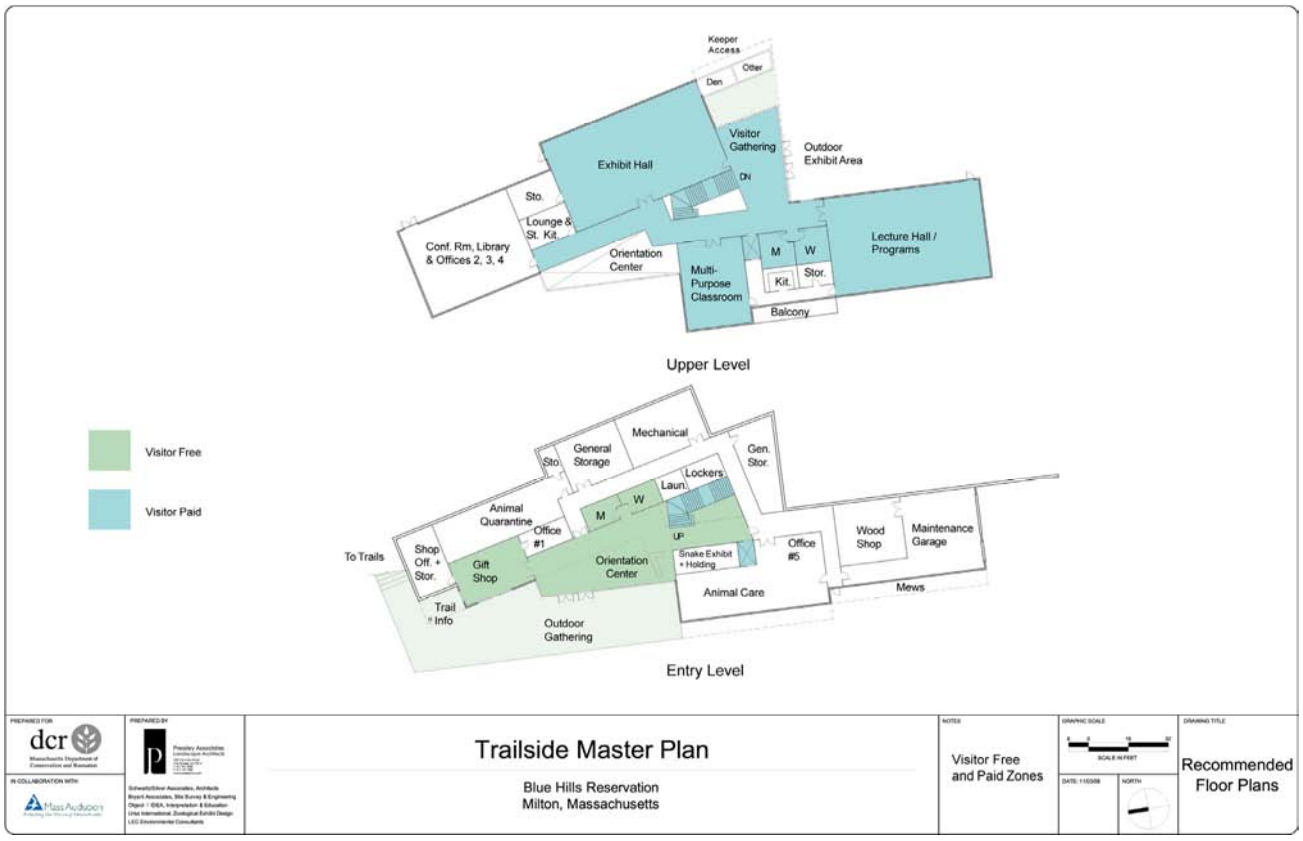
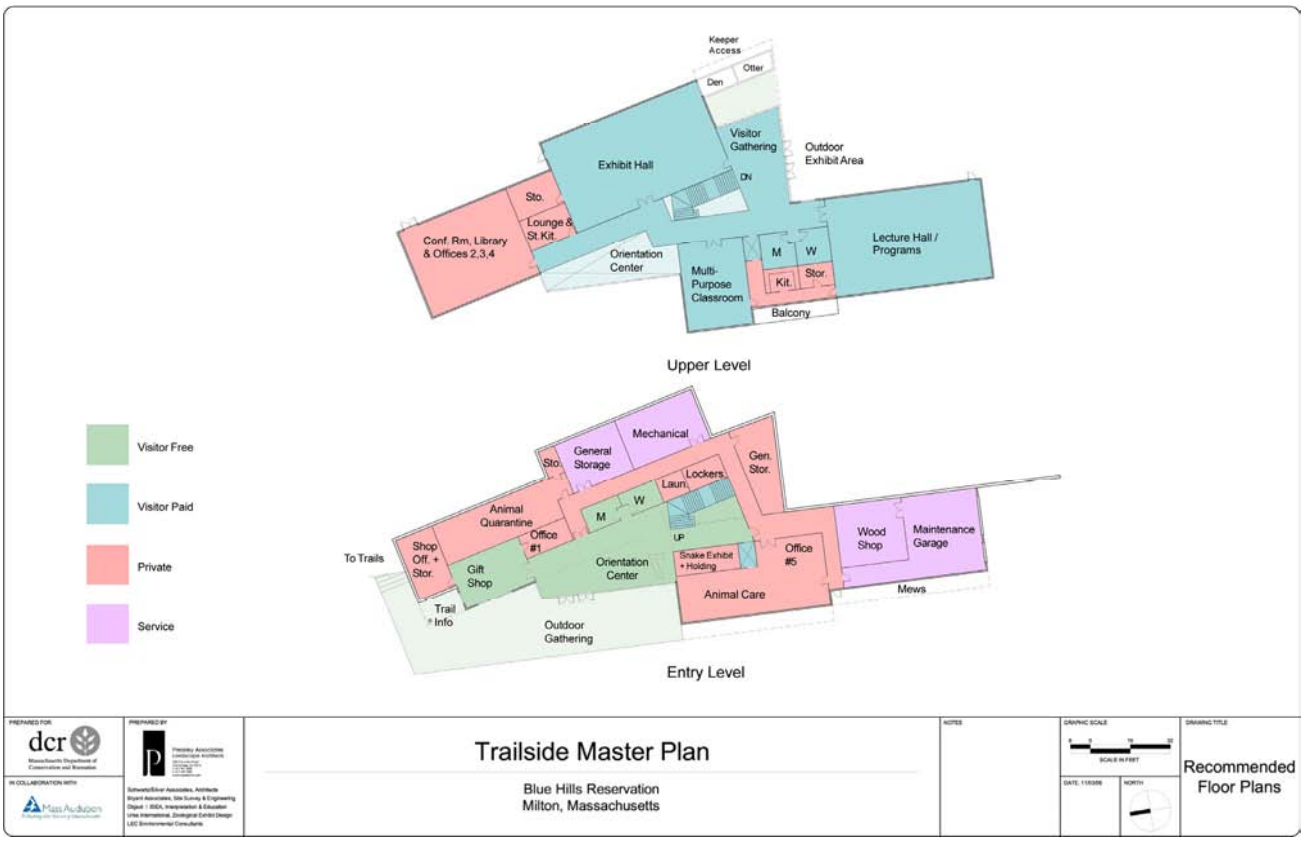
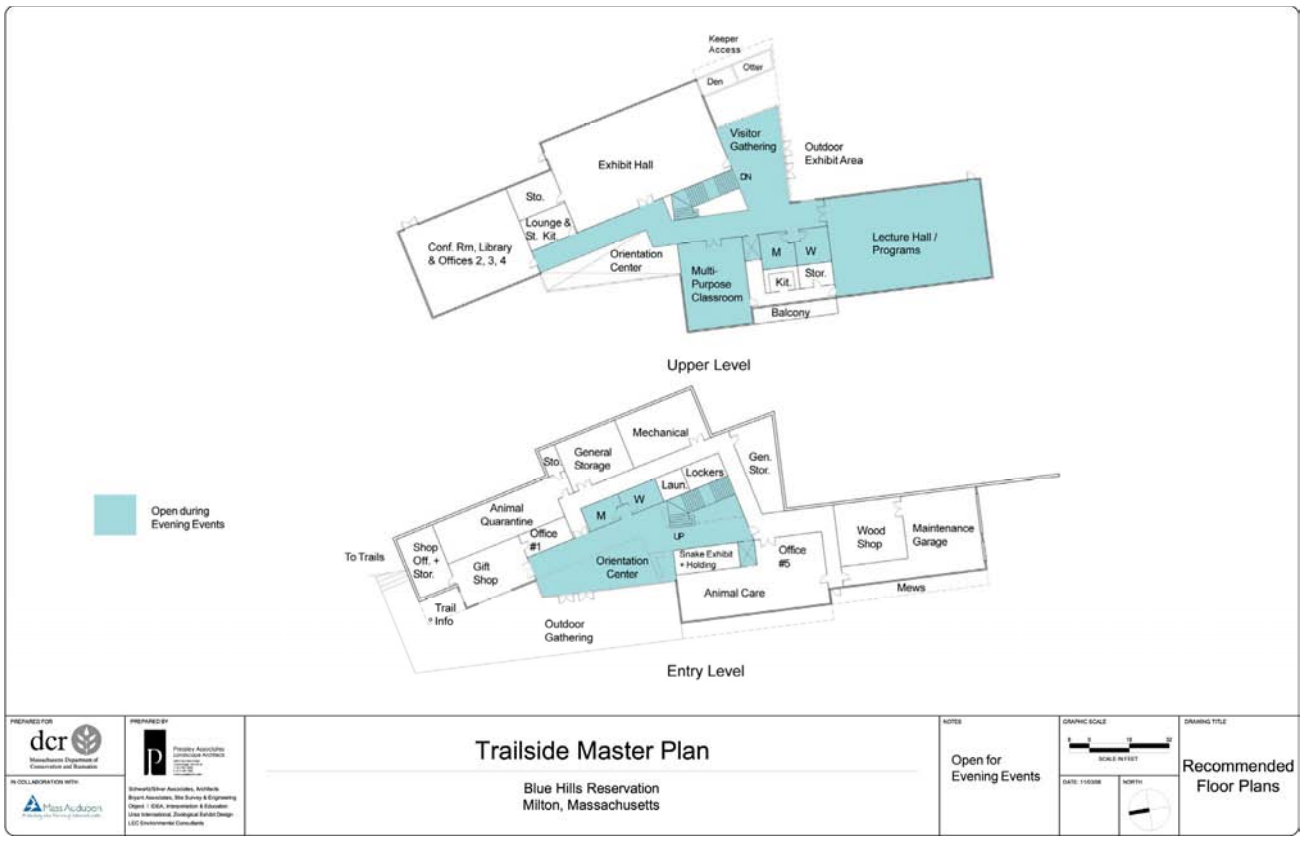


Diagram showing visitor free and paid zones in the proposed nature education center (Schwartz/Silver Architects).



Allocation of visitor, private (Trailside staff only) and service areas (Schwartz/Silver Architects).



Building areas open during special events (Schwartz/Silver Architects).

Except for the administrative offices, which are entered from the upper-level visitor areas, all staff areas are served by a staff-only corridor system at the lower level, connected to an enclosed garage accessed by a service drive.

This separate circulation creates a secure work environment for staff, provides a necessary barrier between Animal Care areas and a likely increased visitor population, and serves as a second means of egress for staff and visitors under emergency conditions.

The specific layout of staff amenities such as a research library and kitchen could be developed in later design phases, in the areas indicated on the plan for conference, offices, and lounge.

Environment and Sustainability

The building will strongly express responsibility and appreciation for the environment, in its construction, operations and appearance. For construction and operations, the agreed standard for sustainability in building design is the U.S. Green Building Council LEED certification system, and the “Platinum” or "Gold" certification level is recommended for this building. Sustainable design under the LEED system will steer the project towards, for example, use of local and recycled materials and high-efficiency building systems. Because this building will be both an educational exhibit and an animal facility, it will require that a relatively stable interior HVAC environment be maintained, so investment in efficient equipment will minimize energy costs over the long term. The building's orientation to the outdoors will be underscored by its use of regional wood and stone materials, its abundant daylight and ventilation, and its views out to the surrounding natural environment.

Conceptual perspective rendering showing the proposed Trailside building from the approach path leading from the north parking lot, with Great Blue Hill in the background. This drawing is conceptual in nature and should be developed in greater detail, along with more detailed site features, as the design progresses in subsequent phases (Schwartz/Silver Architects).

Conceptual perspective rendering showing the proposed Trailside building from the approach path leading from the north parking lot, with Great Blue Hill in the background. This drawing is conceptual in nature and should be developed in greater detail, along with more detailed site features, as the design progresses in subsequent phases (Schwartz/Silver Architects).

Exhibit/Interpretive Concepts

The Exhibit Experience at Trailside: Approach

As visitors approach the site, new architecture, improved site and traffic configurations, and signage features will signal a new identity for Trailside. High-quality, photographic banners along the street edge will build anticipation for an encounter with the living animal collections and museum-quality displays. Images will depict multi-generational offerings and express Trailside's uniquely personal approach to interpretation. Educational themes for new Trailside exhibits should be developed to draw visitors in to an enhanced understanding of the natural world, the relationship between humans and nature, and to encourage visitors to explore the Blue Hills further. This may include exhibit themes devoted to the habitats, plants, wildlife, and cultural history of the Blue Hills; Trailside's ongoing research projects (e.g. Snowy Owl and other bird banding projects); seasonal changes in the Blue Hills; environmental stewardship and sustainability; urban-wildland interfaces; biodiversity; and "living green," (including interpreting the new "green" building).

Diverse Motivations | Unified Arrival

New visitors of all types and with varying motivations will be clearly directed to arrive to the north parking lot. The lot may be constructed, planted and interpreted as a demonstration area for natural rainwater run-off management enhancing the educational opportunities from the very onset of arrival.

Clear signage will invite all guests to approach the building via the historic Canton Ave. Restroom and a slightly sloped path that skirts along the pond. While the arrival path is short, it may feature some brief descriptions of the habitats that can be found in the Blue Hills, especially in the immediate vicinity of Trailside.

Experienced visitors, those with long-standing ties to the south parking lot and to the Red-dot Trailhead will not be disappointed to find a new and improved trailhead not far from its former location. Newly fitted with a graphic map and descriptions of trail features, this trailhead is one in a small series of new trailhead markers found on the site.

Arrival to the building is marked with a grand arrival veranda and gathering space. From this point of arrival, diverse visitors with an equally diverse set of motivations have many clear options at hand:

Solo or small parties of hikers, familiar with the Blue Hills and the new nature education center, may continue from the north parking lot straight to the trailhead kiosk north of the new nature education center. Here they may get an update on trail conditions; plan a hike by using the graphic map and list of features, destinations and travel times; or may browse news and sightings that have been posted by Trailside naturalists and program participants. Additionally, the kiosk reminds hikers of the responsible hiking behaviors that ensure that the Blue Hills Reservation remains safe and enjoyable for future hikers and the wildlife that calls it home. The kiosk is located at connections to the Wolcott Path and Red Dot Trail.

New hikers may wish to engage the services of a naturalist or reservation staff by entering the building. Here they can get some first-hand consultation and purchase basic supplies like water, snacks and guidebooks. A "walk-up window" tied to the outfitting center at the Gift Shop, permits hikers to purchase simple supplies from the north side of the building.

Organized groups (school groups, Elderhostel tours and others) can be formally welcomed and oriented at the Amphitheater. All visitors will delight to find a sloped Amphitheater at the point of arrival. Not only serving as a venue for formal and informal presentations, the abundant, casual seating invites visitors to linger, converse, and rest. The amphitheater is the perfectly memorable spot where groups can re-join after having dispersed to engage in separate pursuits.

Those persons wishing to see the exhibitions and animal displays will be invited to enter the building.

For visitors participating in special indoor programs or events, the Lecture Hall is easily found on the second level. Presentations can also be staged outdoors at the Amphitheater and at the program/picnic area set within the context of the animal exhibitions.

Trailside Orientation Center

Arrival into the building underscores the "gateway" function of the building. Expressed as a glass passageway between two buildings, the gateway is clear. The Orientation Center (lobby) offers a taste of what the Blue Hills has to offer: educational programs, diverse landscape features, and encounters with wildlife. The interior space celebrates the Blue Hills, providing a strong sense of place and blurring the boundaries of indoors and out. The Orientation Center (ground floor) is an entirely free space, providing visitors with a strong sense of arrival and orientation:

- A staffed information desk offers expert advice for how to best enjoy an excursion outdoors.
- Restrooms are readily available (although the Canton Ave. restroom is the primary restroom for trail users).
- A large map of the Blue Hills Reservation aids in trip planning by illustrating the hiking trails, and the outdoor exhibition experience at Trailside.
- An animal habitat (e.g. live snakes and/or reptiles) signals the animal collection and offers a sneak peek into the interpretive exhibits. Nearby, lists of sightings made by visitors will encourage active participation in the interpretation of the site.
- A grand stair and granite boulders symbolizes the ascent of the Red Dot Trail from the base of Great Blue Hill to the summit. A biodiversity tower replete with specimens (nests, feathers, casts of animal tracks, shells, leaves, stones, fossils, etc.) showcases the species and habitat diversity that one might experience on a trek in the Blue Hills.
- At the top of the stair, dramatic views to the exhibitions (both indoors and out) provoke visitors to purchase a ticket and explore the natural and cultural history of the Blue Hills Reservation through Trailside's exhibit offerings.
- The Outfitting Center (Gift Shop) is a light retail space offering keepsakes and simple day-trip supplies that might make one's hike more pleasant – maps, trail snacks, bottled water, etc. The Gift Shop provides books on natural and cultural history, outdoor recreation, etc. with opportunities for staff and volunteers to stage impromptu exhibits in the built-in cubbies. For people who visit Trailside regularly, the Gift Shop Outfitting Center and Orientation Center may serve as a home base.

Conceptual rendering of the lobby/Orientation Center inside the proposed Trailside nature education center, showing the free visitor area providing general information for the Blue Hills Reservation, with the paid exhibit space on the second floor (objectIDEA).

Additional Features Proposed in the Master Plan

Exhibits

With the new nature education center set into the slope, the second floor offers a new "departure point" into the interpretive exhibits at Trailside. The relationship between the indoor and outdoor exhibit experiences is reinforced by the architecture and as a result, the interpretive program can be strengthened. There is an opportunity for more direct observation of nature from indoors and, once ticketed, visitors may venture in and out of doors freely. The paid/unpaid boundary and the need to "lure" people into the building will no longer be an issue.

Opportunities to enhance the exhibition program with live interpretation (education staff and volunteers) and research (like the snowy owl project and bird banding) are possible in the new configuration. With a staffed information desk, a Gift Shop (outfitting center), and program space in the formal exhibit galleries (indoors and out), guided experiences are possible right alongside the self-guided experience.

A conscious effort has been made to highlight the concept that the "real" experience at the Blue Hills Reservation is not contained in a building or confined by a perimeter fence. The blurring of the boundaries of the building, and an improved relationship between indoor and outdoor experiences make this idea one of the primary interpretive goals as specific exhibitions take shape in further phases of design.

The outdoor exhibition program has been expanded to showcase plant communities and geography in a way that was not possible in Trailside's earlier iterations. In this Master Plan, it is suggested that the outdoor exhibits be expanded beyond the menagerie approach, and embrace the interpretation of the diversity of habitats and dynamism of ecosystems equally with the plants and animals that inhabit them. This is in concert with the Trailside Museum Interpretive Plan (July 2005), which has been an important guide in the development of this Master Plan and has therefore been included in the appendix.

Indoor exhibits must change frequently in order to attract and hold an audience. With the outdoor exhibits doing what they do

best: interpreting living things and active habitats, it might prove interesting to think of the indoor Exhibit Hall as a story of change – over time, over place, across elevation and across the seasons. And as a managed landscape, there is always the dynamic that humans apply to the landscape in their efforts to develop, inhabit, preserve, and protect the Blue Hills. While the majority of the exhibit discussion focuses on the ecology of the Blue Hills, two other themes are central to Trailside and should be explored in the next phase of design. First, the cultural history of the Blue Hills, from Native American history to early settlements and the establishment of the Metropolitan Park System is an important part of the interpretive story of Trailside. Second, environmental sustainability and land stewardship, which are central to the missions of DCR and MAS and further reinforced in the green architecture of the new nature education center, should be included in the exhibit design.

Habitats of the Blue Hills

The Blue Hills area contains a remarkable diversity of topography and habitat types including rocky summits and outcrops, natural forested uplands, maintained grasslands and wet meadows, large ponds and associated marshes, forested wetlands and the largest Atlantic White Cedar Bog in Massachusetts, which could be explained through exhibits and programs at Trailside. These habitats possess a rich variety of flora and fauna, including rare and endangered species found nowhere else in the state. The Blue Hills Reservation is particularly noteworthy when one considers the diversity of flora and fauna it contains while at the same time being located just a few miles from the city of Boston. Within a surrounding area of dense development and infrastructure, the Reservation protects an array of unique and valuable habitats, along with the rich wildlife these areas support. The Reservation also protects key habitats for many rare species and offers the public exceptional opportunities for education and interpretation in addition to recreation. These habitats, listed below, form an important concept both for the interior and exterior exhibits. For example, the outdoor exhibit areas noted generally on the Recommended Site Plan should be developed to illustrate the plant species associated with each of the habitats of the Blue Hills.

The Natural Heritage and Endangered Species Program (NHESP) BioMap Project identifies three Core Habitats within the Reservation, areas regarded as especially important sites for biodiversity conservation across the state.

Table 4.1: Habitats of the Blue Hills

1. Rocky Summits/Outcrops
   - Pitch Pine/Scrub Oak dominated forest
2. Upland Forest
   - Coniferous
   - Deciduous
   - Mixed coniferous/deciduous
3. Scrub/Shrub Wetlands
4. Shallow Freshwater Marsh Wetlands
5. Wet Meadows
6. Riverine/Floodplain Wetlands
   - Forested
   - Open Marsh
   - Scrub/Shrub
7. Forested Wetlands/Wooded Swamp
   - Coniferous
   - Deciduous
   - Mixed coniferous/deciduous
8. Open Water Habitat
   - Ponds/Lakes
   - Rivers
   - Streams – Riparian Habitat
9. Acidic Peatland Community Systems
   - Atlantic White Cedar Bog
   - Pond-margin Peatland Bog
10. Natural Meadows
11. Maintained Grasslands & Meadows

Rocky Summits and Outcrops

One of the most notable habitat types within the Blue Hills are the rocky summits and outcrops located on the many hilltops within the park. These ridgetop high elevation areas (relative to the surrounding landscape) are open communities of sparse vegetation, acidic soils and exposed granite ledges. These sites are very dry with minimal soil present and contain scattered shrubs, grasses, mosses, lichens and patchy tree cover. Dominant vegetation found in these wind-swept hilltop areas includes Pitch Pine (*Pinus rigida*), Scrub Oak (*Quercus ilicifolia*), Lowbush Blueberry (*Vaccinium angustifolium*) and Huckleberry (*Gaylussacia* sp.). Common Polypody Fern (*Polypodium virginianum*) is present on less exposed rock surfaces. According to NHESP BioMap Core Habitat summaries for the region, these acidic rocky summits and slopes provide key habitat for several rare insect species including Hentz's Redbelly Tiger Beetle (*Cicindela rufiventris hentzii*), the Oak Hairstreak Butterfly (*Satyrium favonius*) and the Waxed Sallow Moth (*Chaetaglaea cerata*).

Forested Uplands

The rocky hilltops of the Blue Hills are almost entirely surrounded by steeply sloping forested uplands, such as those that occur at Trailside. Prior to the 1940's and the onset of the chestnut blight, the American Chestnut (*Castanea dentata*) dominated the canopy of these areas. The surviving sprouts of these chestnut trees are still common throughout the forest, readily observed in the open understory. Today these upland forests still show the effects of human activities such as logging and farming and recently fires have altered the landscape as well. Dominant tree species in these upland forests include White Pine (*Pinus strobus*); Red, Black and White Oaks (*Quercus* sp.), Black Birch and Paper Birch (*Betula* sp.) and Eastern Hemlock (*Tsuga canadensis*). Also common more locally are Sassafras *(Sassafras albidum*), Red Maple (*Acer rubrum*), American Beech (*Fagus grandifolia*), and Hickory (*Carya* sp.). The understory of these forested upland slopes is typically open with a relatively sparse shrub and sapling layer. Common shrub species include Witch Hazel (*Hamamelis virginiana*), Maple-leaved Viburnum (*Viburnum acerifolium*), Sweet Pepper Bush (*Clethra alnifolia*), Highbush and Lowbush Blueberry (*Vaccinium* sp.) and Huckleberry. Dominant ground-cover species include Wild Sarsaparilla (*Aralia nudicaulis*), Bracken Fern (*Pteridium aquilinum*), and Canada Mayflower (*Maianthemem canadense*). Locally abundant are Yellow Stargrass (*Hypoxis hirsuta*), False Solomon's Seal (*Smilacina racemosa*) and Lily-of-the-valley (*Convallaria majalis*). In areas recently affected by fire, resulting in a more open canopy, the dominant ground cover transitions to Hay-scented Fern (*Dennstaedtia punctilobula*), Sweet Fern (*Comptonia peregrina*) and Deer-tongue Grass (*Panicum clandestinum*). These upland forest communities provide important habitat and forage for Gray Squirrels (*Sciurus carolinensis*), Chipmunks (*Tamias striatus)* and Eastern Wild Turkeys (*Meleagris gallopavo silvestris*).

Transition from Upland to Wetland

One of the unique features of the Blue Hills reservation is the opportunity to observe the changes in flora and fauna as one travels from the dry rocky hilltops, down through the forested uplands, and eventually arrives at the wet forested lowlands and swamps. As the landscape transitions from upland to wetland, the vegetation changes correspondingly. Red Maple becomes more prevalent, along with patches of Chestnut Oak (*Quercus prinus*) and Yellow Birch (*Betula alleghaniensis*). The shrub layer thickens with a higher density of Sweet Pepper Bush and Highbush Blueberry, and new shrub species are observed including Spicebush (*Lindera benzoin*) and Winterberry (*Ilex verticillata*). Fern species such as Cinnamon Fern (*Osmunda cinnamomea*), New York Fern (*Thelypteris noveboracensis*) and Interrupted Fern (*Osmunda claytoniana*) appear in the groundcover. When one reaches the swamps, groundcover species such as Skunk Cabbage (*Symplocarpus foetidus*) and Royal Fern (*Osmunda regalis*) become prominent and less common tree species such as Black Tupelo (*Nyssa sylvatica*) are observed.

Atlantic White Cedar Swamps

The other most notable and unique habitat type found in the Blue Hills Reservation occurs in these lowland areas - Atlantic White Cedar Swamps. These Atlantic Cedar dominated wetlands are found in two areas of the Reservation. The "Great Cedar Swamp" is located in the easternmost section of the Reservation and an Atlantic White Cedar Bog is located in the south on the margin of Ponkapoag Pond. The NHESP BioMap project identifies the Ponkapoag Bog as the best pond-margin peatland remaining in eastern Massachusetts. This bog contains a nearly uninterrupted heath shrub layer and an open canopy dominated by Atlantic White Cedar and Red Maple. Dominant ground cover and shrub species include Sphagnum Moss (*Sphagnum* sp.), American Cranberry (*Vaccinium macrocarpon*) and Leatherleaf (*Chamaedaphne calyculata*). Unique plant species that thrive in acidic, nutrient-poor conditions are present such as pitcher plants (*Sarracenia* sp.), sundews (*Drosera* sp.), and bladderworts (*Utricularia* sp.). According to NHESP, this bog is a critical site for a diversity of rare insect species and also encompasses significant habitat for the Blue-spotted Salamander (*Ambystoma laterale*) and several turtle species.

Freshwater Marsh

The Neponset River is located in the Fowl Meadow section of the Blue Hills Reservation and this western portion of the property contains yet another valuable habitat type – freshwater marshes. These freshwater floodplain wetlands are comprised of large areas of standing water containing cattails (*Typha* sp.), dogwoods (*Cornus* sp.) and willows (*Salix* sp.). Problematic invasive species such as Phragmites (*Phragmites* sp.) and Purple Loosestrife (*Lythrum salicaria*) are also present in high densities. Despite the invasive species, the area provides valuable bird habitat for species such as the Great Blue Heron (*Ardea herodias herodias*) and the endangered Least Bittern (*Ixobrychus exilis*). This area is also designated as a Core Habitat by the NHESP BioMap Project.

Zoological Exhibits

Animal Collection

The live exhibits at Trailside have been developed with a series of assumptions. Early on in Phase 2 – programming and alternatives, DCR, MAS and the consultant team identified the animals to be designed for – the species list. For the most part, this consists of the current species list for Trailside, including those species exhibited currently or in the recent past, and which they have had good experience with (see Table 4.2 below). Additional animals native to the Blue Hills, but no longer found here, are also proposed in the initial and expanded exhibit area, based on feedback from the Trailside Advisory Committee. The appropriate exhibit size (above minimum standards) and type standards for each species were also determined. Some are open, moated exhibits and some are mesh enclosures due to the specific requirements for each species.

While these exhibits area planned for a specific species, they can be re-purposed depending on the current needs of DCR, MAS and Trailside. Flexibility was considered in the selection of each exhibit. The only unifying element is that the animals are all native to Blue Hill. The additional exhibits are planned as 'future expansion' habitats. These include animals that have never been exhibited at Trailside, but which would add significantly to the educational experience since they once inhabited the Blue Hills, i.e. Black Bear, Coyote, and Bobcat.[1]

Table 4.2: Species Included in Initial Exhibits

MAMMALS		Area	
River Otter	*Lutra canadensis*	4250	sf
Possum	*Didephis virginianus*	150	sf
White-tail Deer	*Odocoileus virginianus*	6300	sf
		12,400	sf[2]
Striped Skunk	*Mephitis mephitis*	240	sf
Red Fox	*Vulpes vulpes*	1800	sf
Fisher	*Martes pennanti*	800	sf
BIRDS			
Wild Turkey	*Meleagris gallopavo silvestris*	1800	sf
Turkey Vulture	*Cathartes aura*	1800	sf
Red-tailed Hawk	*Buteo jamaicensis*	800	sf
Snowy Owl	*Bubo scandiacus*	240	sf
Barn Owl	*Tyto alba*	216	sf
REPTILES AND AMPHIBIANS			
Timber Rattlesnake	*Crotalus adamenteus*	25	sf
Northern Copperhead	*Agkistrodon contortrix*	25	sf
Black Rat Snake	*Elaphe obsoleta obsoleta*	15	sf
Grey Tree Frog	*Hyla versicolor*	800	sf
American Toad	*Bufo americanus*	800	sf
Bullfrog	*Rana catesbeiana*	800	sf
Snapping Turtle	*Chelydra serpentine*	800	sf
Other native Turtles		800	sf

Some of the animal species discussed below, would greatly benefit from housing as a family group, which benefits the health and well-being of the animals, provides additional educational opportunities for visitors (through a broader display of natural behaviors), and poses the potential for exchange with other institutions. However, MAS currently has a policy forbidding the breeding of captive native species. This Master Plan recommends that MAS revisit this issue as further educational opportunities and enhanced animal well-being is improved if family groups and breeding is permitted.

For more detail on the individual exhibit requirements, including number of animals, enclosure size, habitat amenities, holding areas and keeper access, please see Appendix C.

Fisher (Martes pennanti) – one of the new species recommended for the initial outdoor exhibits at Trailside.

Otter at Woodland Park Zoo, Seattle, WA (Woodland Park Zoo).

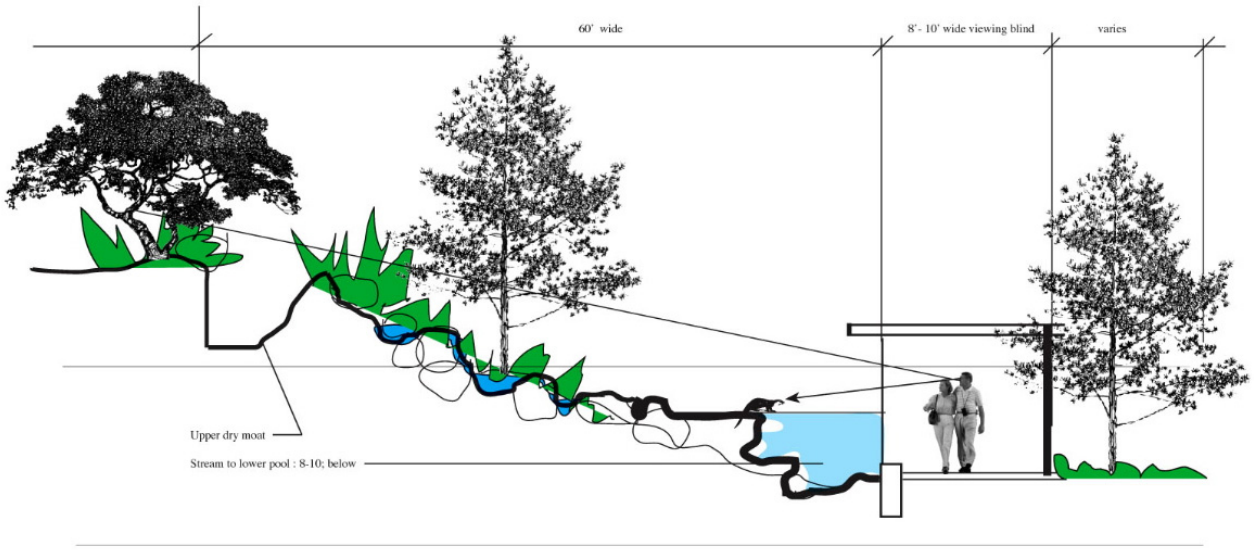
Otter Exhibit

The new 4,250 s.f. River Otter exhibit is the first outdoor exhibit encountered by the visitors. While still inside, the Exhibit Hall provides a view into the otter "den", which is adjacent to the otter holding, and provides a secondary exhibit area and resting place on-exhibit but indoors. This simulation of a streamside den space would allow close-up (through glass) viewing when the otters have pups or when there is an extra animal in the collection. There is also a great view from the upper gathering area into the exterior exhibit, which consists of a large pool, a stream and an upland area. The pool is 4-5' deep and formed with 'gunite' concrete and shaped to provide good water circulation, interesting objects for the otters to explore and natural claybanks and pool bottom to be seen from the viewing area. A hidden drain in the deepest point provides a return for the water into the filtration system.

The pool is fed by another artificial water feature – the stream. This exhibit feature could resemble a waterfall with boulders and logs distributed from the top of the exhibit to the pool. A well-placed, fabricated, hollowed log can act as a slide for the otters to play in, which allows the visitors to see otter natural behaviors. An elaborate filtration and recirculation system will be provided to screen and sanitize the water to allow for a clear presentation through the glass. The upland area of the exhibit should contain natural substrates, grasses and small plantings. This area will be popular for the otters to sun themselves and play. This area is surrounded by artificial claybanks and large rock features, which act as the primary barrier for the exhibit.

The visitors view the exhibit through glass from the main path, under a shade roof cover. The water is approximately 3' high on the glass to allow easy underwater viewing. From this viewpoint, the stream and upland areas of the exhibit are also viewed. There is a secondary view from the gathering area that depicts the upland area of the exhibit.

A holding area is adjacent to the exhibit, which provides two, interconnected, 5' x 8' x 7' high dens with direct access to the exhibit as well as the exhibit den. Keeper access is provided from outside the exhibit into the den areas for cleaning and observation, and it also provides access into the exhibit. This exhibit is expected to house one family group of River Otters and allow for breeding a sustainable population.[3]



Conceptual section of the proposed River Otter exhibit, showing the view from the main visitor path (Ursa International).

Native turtles at the Toledo Zoo, Toledo, OH (Toledo Zoo).

Turtle Exhibit

On the other side of the path from the otter exhibit is another pool to continue the wetland theme: this exhibit is for the turtles. This exhibit depicts a small wetland of the Blue Hill with a variety of local turtles including a Musk Turtle, Painted Turtles, Spotted Turtles, Wood Turtle and Blandings Turtle, with Eastern Box Turtles inhabiting the upland portion of the exhibit. A separate pond includes a Snapping Turtle. The pond will be a natural bottom pond with lush plantings. A small holding building (shared with Virginia Opossum) will be provided to secure the turtles overnight and provide proper husbandry services to the population.

The turtle pond will share a filtration system with the River Otter to make an efficient use of water and maintain a clean environment. Visitors will view the turtles above water level behind a handrail to keep them back from the edge of the pond. This exhibit should provide an excellent opportunity to see the many varieties of local turtles and study their differences.

Virginia Opossum (Public domain image from English Wikipedia)

Virginia Opossum Exhibit

Next to the turtle pond will be the Virginia Opossum exhibit. The new 216 sf. opossum exhibit is small yet complex. It is a complete enclosure with mesh walls and roof to allow the family group to access all of the 3-dimensional space. These arboreal mammals are adapted to living off the ground, so there will be a tangle of branches and vines throughout the space for them to climb and perch.

A small water feature will be provided to give them access to running drinking water. In the wild, opossums are known to prefer wet environments near streams and swamps.

A hollow log will act as a shelter for this adaptable creature. The visitors have a close-up viewing opportunity with this small exhibit.

White-tailed Deer (Joe Kosack/PGC Photo)

White-tailed Deer Exhibit

On the uphill side of the trail, the visitors come upon the White-tailed Deer exhibit. This is a rather large, wooded enclosure, approximately 9,600 s.f. of oak/pine woodland with a dense perimeter understory to hide the 8' chainlink fence necessary to contain the species. The front barrier consists of an 8' deep moat with a sloping side towards the exhibit and a vertical wall on the visitor side that contains the White-tailed Deer. This provides a wide-open view into the exhibit and permits the visitor to feel a part of the woodland experience. Planted islands on the visitor path immerse the visitors into the deer habitat. The view into the exhibit and into the borrowed landscape of the Blue Hill Reservation gives the impression of an extensive exhibit area.

A holding barn and service yard is located off to one side, out of view, with several stalls and a group paddock to manage the small herd of White-tailed Deer (e.g. 1 male and 2 females) in a safe and professional way. This wooden barn allows a method to separate the male from the females as necessary or allows the deer to be fed off-exhibit while keepers check the habitat. A service yard is provided to store hay and remove manure from the area.

Section showing concept for White-tailed Deer enclosure (Ursa International)

Barn Owl (Public domain image from English Wikipedia)

Barn Owl Exhibit

A 216 s.f., Barn Owl exhibit is located adjacent to the White-tailed Deer holding barn, to explore the connection between Barn Owls and Barns. In the wild, Barn Owls have been known to take up residence in barns because of they provide shelter and the abundance of food supply - mice.

This mesh enclosure will permit the Barn Owls to perch up high in the eaves of the barn with various perches associated with barn construction. This will allow the birds to be protected in cold months and still be maintained on-view. The exhibit landscape will simulate a farmyard, with farming tools and meadow grasses and forbs.

This exhibit will ultimately help hide some of the White-tailed Deer barn and put this exhibit in context for the visitors, while getting a close-up view of one of the Blue Hill residents.

Red Fox (Dan Walters, www.photo.net)

Red Fox Exhibit

Across from the Barn Owl, the abandoned farm landscape extends through the Red Fox exhibit as an open meadow and rocky outcrop that continues down to the pond.

The 1800 s.f. exhibit contains natural substrates, fallen logs, meadow plantings and dense screening plant material to hide the edges of the exhibit and the small holding building.

Visitors are able to view the foxes through glass under a small viewing blind along one side allowing the visitors to watch the activity from a shaded overlook, as the foxes go about their daily routines. It will be important for the keepers to prepare enrichment for the foxes, as they are smart and will want to manipulate their environment.

The holding building will provide hands-off management for the foxes with two, interconnected, 5'x 8' dens with direct access to the exhibit and to the keeper hall. Here, the keepers will be able to monitor their health and be able to administer any treatment necessary.

The holding area is hidden from view with a rock feature façade that extends to a large rocky outcrop on the back-side of the exhibit.

Snowy Owl at the Woodland Park Zoo (Woodland Park Zoo).

Snowy Owl Exhibit

Continuing down the path, the visitor enters an area devoted to the upper reaches of the Blue Hill, where rocky outcrops provide habitat for large raptors. The Snowy Owl will typically winter in the Blue Hills, which is part of the southernmost extent of their range.

This majestic raptor can be seen nesting under Spruce boughs on exposed bedrock. From their protected lookout, the visitors can get a good look at their impressive size and plumage.

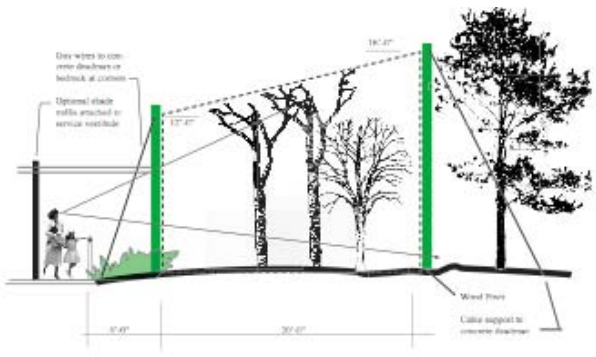
The 240 s.f. exhibit can hold a pair of owls, where visitors can observe the different plumages between the males and females. There is no need for a holding building, as they are seasonally native, but they will need dense vegetation to stay cool in the hot summer in Boston.

The exhibit will interpret some of the research that is being conducted by Trailside staff on the Blue Hill, which will help to gather support of the work.

Red-tailed Hawk (Bill Garland, FWS.gov).

Red-tailed Hawk Exhibit

Next door to, and sharing exhibit access, is a larger, 800 s.f. mesh structure for Red-tailed Hawks. This exhibit averages 14' high allowing the hawks to nest on trees, high off the ground, as they would in the wild. This is a wide exhibit that allows the hawks to fly from perch to perch, to show visitors their 4' wingspan. Multiple hawks can be exhibited together in this enclosure, or multiple hawk sub-species, as is currently done. Visitor viewing will be through mesh, from a shaded viewing blind. A handrail set back 6' from the mesh will allow for safe viewing and comfort for the birds.



Section showing concept for Red-tailed Hawk enclosure (Ursa International)

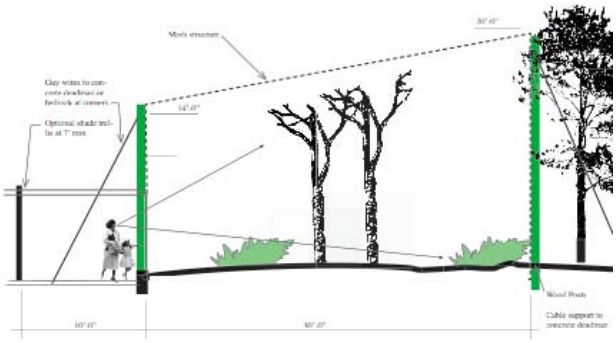
Eastern Wild Turkey (public domain image from English Wikipedia).

Eastern Wild Turkey

Nestled into the oak/pine forest is an 1800 s.f. mesh structure for the Eastern Wild Turkey. They occupy the same habitat as the White-tailed Deer in the Blue Hills Reservation and their proximity will reinforce this story. This is an impressive bird when it flies, and this exhibit will be design to promote this behavior, with multiple perches and open grassland. The exhibit is designed to support a small flock (e.g. 1 male and 3 female turkeys).

Viewing will be through mesh from a shaded viewblind with interpretive panels related to the significance of this species.

There is a shared keeper service area for both the Eastern Wild Turkey and the Turkey Vulture that allows access to either exhibit through a common area



Section showing concept for the Eastern Wild Turkey enclosure (Ursa International)

Turkey Vulture (public domain image from English Wikipedia).

Turkey Vulture Exhibit

Completing the raptor exhibits in the Rocky Outcrop area is a large, mesh structure for Turkey Vultures. This 1800 s.f. exhibit has an 18' average height to provide multiple options for the bird to perch and fly. Their 5'-6' wingspan will be very impressive to watch. The visitors will be able to watch them through mesh from a shaded view blind.

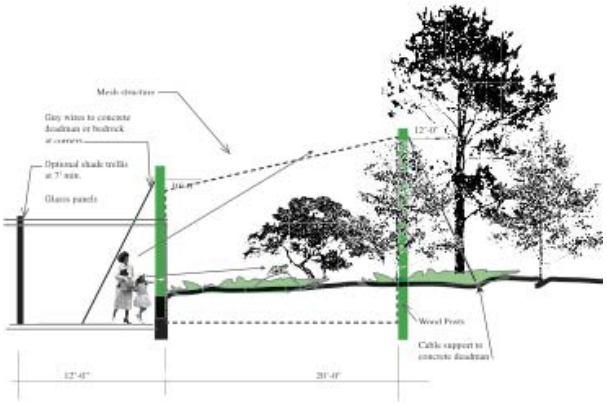
Fisher (photo by: Boralforest.org)

Fisher Exhibit

The Fisher exhibit is an 800 s.f. mesh enclosure with lots of branches and rocks for the animals to climb on and interact with. The exhibit is designed for a pair of Fisher and their offspring and will accommodate their needs by various enrichment items that are changed on a regular basis.[4]

Viewing will be through glass from a shaded viewblind off the trail. The vegetation will be a dense coniferous forest setting.

The holding is combined with the Striped Skunk exhibit, and will provide safe access to the exhibit and management area for the Fisher.



Section showing concept for Fisher enclosure (Ursa International).

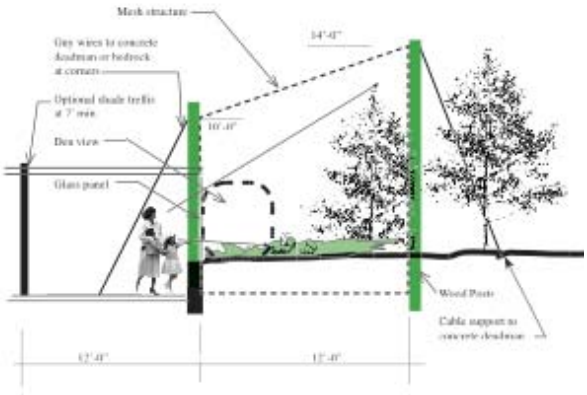
Striped Skunk (Borealforest.org)

Striped Skunk Exhibit

The Striped Skunk exhibit is a 240 s.f. mesh enclosure is similar to the Fisher exhibit, but is more open and grassy, as the skunks are more comfortable in exposed areas. Their ability to warn off threats with their scent is well known, and provides them more safety in the wild, (these specimen will be de-scented).

Viewing will be through glass from a shaded viewblind off the trail with potential viewing into an indoor den.

The holding area is combined with the Fisher exhibit, and will provide safe access to the exhibit and management area for the skunks.



Section showing concept for Striped Skunk enclosure (Ursa International).

Timber Rattlesnake (www.thewatersnake.com).

Copperhead and Timber Rattlesnake Exhibits

The Copperhead and Timber Rattlesnakes at Trailside reside at the lower floor of the building, in the Orientation Center (lobby) by the elevator. Two exhibits are backed up by a safe “hot room” that provides a secondary level of security for the poisonous snake collection. This is a central work area with sealed doorways, alarms and other features that prevent any accidental snake escapes into the park or building. This room is set into the Animal Care area and only accessible through a secure door.

The two exhibits are each 25 s.f. and have non-glare glass fronts, and fiberglass enclosures that are textured and themed to appear as rocky dens for the snakes to rest. There are shift cages for the snakes to get out of the exhibit so the staff can clean the exhibits.

The visitors are given these two exhibits as the only ‘free’ view of live animals. It may also be possible to add a third, smaller exhibit to this area, such as a small mammal.

The Copperhead and Timber Rattlesnake exhibit is located in the free lobby area and provides the opportunity to increase awareness of the Reservation’s venomous snakes to benefit increased conservation efforts.

Drainage and Stormwater Management

Consistent with the Phase 1 Site Inventory and Assessment, site analysis and recommendations for the Preferred Alternative have been prepared and presented in three discrete parts, the south parking lot, Blue Hills Pond, and the north parking lot. Figures 1, 2 and 3, which are included as Appendix B depict existing drainage areas, post-development drainage areas, and suggested improvements (Preferred Alternative).

South Parking Lot

Drainage Area Analysis

Existing Conditions

The area contributing runoff to the south parking lot consists primarily of a portion of the steep, forested hillside of Great Blue Hill, up to the Blue Hill Observatory. Runoff from the southerly side of the Trailside site and from the parking lot pavement also contributes to this system, for a total of approximately 21 acres (Figure 1 in Appendix B). A 15" diameter reinforced concrete pipe culvert has been observed, which would appear to channel runoff from the south parking lot catch basin, under the driveway to the south, discharging to the ground through a headwall located south of the driveway. Approximately 55,000 square feet (1.2 acres) of the existing tributary area is impervious.

Preferred Alternative

After construction of the new building and associated site features, it is assumed that the runoff from a portion of the expanded Trailside site east of the south parking lot will be diverted, through changes in site grading, toward Blue Hills Pond. It is estimated that this will result in a net reduction in the area tributary to the south parking lot of approximately 1.5 acres (Figure 2 in Appendix B). This reduction in tributary area represents contributions from the Trailside site only. Analysis and quantification of changes in runoff contribution from beyond the site (hillside) will depend on the final distribution of runoff, as recommendations are more fully developed and implemented in future design phases. Approximately 53,000 square feet (1.2 acres) of the revised site tributary area is impervious.

Suggested Improvements

Several improvements are recommended, with the goal of reducing sedimentation and oil contamination of the downstream drainage/receiving system (Figure 3 – Appendix B).

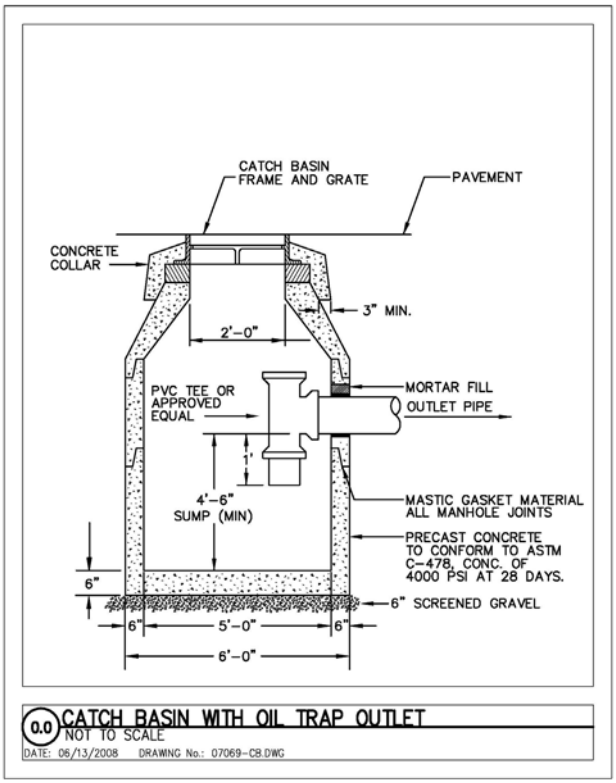
A swale can be constructed around the eastern perimeter of the site, outside of the Red Dot Trail, intercepting runoff from the hillside and directing it toward the center of the parking lot. An energy-dissipating element (to be determined in future design phase) should be constructed at the end of the swale, prior to discharge to a bioswale running in a southerly direction, parallel to the pedestrian walkway. Overflows from the bioswale would be discharged to the culvert at the southerly end of the parking lot.

Another swale should be constructed parallel to the pedestrian walkway to intercept runoff from a portion of the site to the east, running southerly, culverted under the bottom of the Red Dot Trail, and discharging to the bioswale. Sizing of this swale will be closely dependent on final grading of the developed site.

A closed drainage system, consisting of deep sump catch basins fitted with oil traps (see detail) is recommended for the paved parking area. The parking lot pavement should be curbed and graded to direct pavement runoff to the catch basins. The pre-treated discharge from the drainage system would be directed to an underground detention/infiltration system, to promote recharge of groundwater. Overflows from this system would be directed to the culvert at the southerly end of the parking lot.

Alternatively, the extent of closed drainage could be reduced by constructing a bioswale or similar system to accept pavement runoff, provided that suspended solids and petroleum contaminants are removed from the runoff prior to entering the receiving system. Options for incorporating LID techniques to pretreat and control runoff can be explored during future design efforts.

The receiving culvert at the south end of the lot has been observed to be filled with sediments. At a minimum, this culvert should be cleaned. Future design efforts should include analysis of the capacity of the culvert and downstream system to receive the calculated volumes of runoff and overflows from the parking lot and its tributary drainage area.



Proposed detail for deep sump catch basin with oil trap (Bryant Associates)

Blue Hills Pond

Drainage Area Analysis

Existing Conditions

Blue Hills Pond receives stormwater runoff primarily from the hillside of Great Blue Hill. Runoff is also contributed from the central and eastern portions of the site (Figure 1 – Appendix B). The total area tributary (draining into) to Blue Hills Pond is estimated to be approximately 27 acres. Overflow from Blue Hills Pond is discharged to a stone-lined channel at the northeast end of the pond. This channel continues in a generally northerly direction, roughly parallel to the easterly edge of the north parking lot, to a sedimentation area, and subsequently under Route 138 toward the Neponset River. Approximately 18,000 square feet (0.4 acres) of the existing tributary area is impervious.

Preferred Alternative

Following construction, it is assumed that the runoff from a portion of the expanded Trailside site east of the south parking lot will be diverted, through changes in site grading, toward Blue Hills Pond. In addition, expansion of the site northeasterly will result in additional contribution of runoff to the pond. It is estimated that these will result in a net increase in the area tributary to the Pond of approximately 2.0 acres (Figure 2 – Appendix B). This increase in tributary area represents contributions from the Trailside site only. Analysis and quantification of changes in runoff contribution from beyond the site (hillside) will depend on the final distribution of runoff, as recommendations are more fully developed and implemented in future design phases. Approximately 43,400 square feet (1.0 acre) of the revised site tributary area is impervious.

Suggested Improvements

Refer to Figure 3 in Appendix B for a graphical representation of the improvements recommended for stormwater management in the Blue Hills Pond area. A substantial quantity of runoff is known to enter the site in this area, and has resulted in significant erosion in the past. Two drainage swales were excavated at some point in the past, to channel this flow directly to the Pond, and can be seen in Figure 1 (Appendix B). A new swale can be constructed along the northeastern perimeter of the site, outside of the Red Dot Trail, intercepting runoff from the hillside before it enters the site, and directing it to a culvert, which would run under the new buildings and discharge to the Pond. An energy dissipater is recommended at the outlet from this culvert. It is critical to intercept flows from the hillside upstream of the proposed building, which, in effect, form a wall across the site, blocking the natural overland path of runoff toward the Pond.

The actual dimensions of the swale and culvert will be determined in later design phases based on runoff calculations. At that time, further investigation of drainage alternatives can be considered to ensure that stormwater is handled so that drainage features can be easily maintained by DCR and to prevent opportunities for water damage to the new building.

A second swale can be constructed along the northerly site boundary, diverting runoff from the new buildings and amphitheater, and routing it to a discharge point along the outlet stream from Blue Hills Pond. Runoff from this portion of the site (pre-development) currently flows overland to this outlet stream. The recommended improvements do not alter this pattern, but will create a point source discharge to the stream.

A third swale is recommended along the south side of the access drive, and culverted under the drive and walking path to the Pond.

Roof runoff from the new buildings can be stored in rain barrels, directed to a holding tank, or otherwise captured for use on site.

The need for additional local drainage facilities within the site, such as drywells, to promote groundwater recharge and reduce the volume of runoff to the Pond, may be identified during future design phases.

Depending on the final distribution of runoff, from the site and the hillside, between the Blue Hills Pond and the south parking lot, and the methods employed to minimize site runoff, post-development flows to the Pond may be increased. Future design efforts should include analysis of the hydraulic capacity of the pond overflow channel.

North Parking Lot

Drainage Area Analysis

Existing Conditions

In addition to the rain that falls on the pavement itself, the north parking lot receives runoff from approximately 0.5 acres of the Trailside site directly to the south via overland flow, for a total of approximately 1.7 acres (Figure 1). The pavement is graded for sheet flow from south to north. All runoff makes its way to the Blue Hills Pond outlet stream, either by overland flow or via a single catch basin outlet pipe at the north end of the lot. Approximately 55,000 square feet (1.2 acres) of the existing tributary area is impervious.

Preferred Alternative

In the post-developed condition, the area tributary to the northerly end of the lot is reduced by approximately 0.2 acres (Figure 2 – Appendix B). This reduction in tributary area represents a decrease in the impervious area, particularly through the introduction of a landscape buffer between the parking lot and Canton Avenue, and by removing a strip of previously paved area parallel to the stream from the area tributary to the proposed drainage/recharge system. Approximately 46,000 square feet (1.0 acres) of the revised site tributary area is impervious.

Suggested Improvements

Similar to the South Parking Lot, a closed drainage system, consisting of deep sump catch basins fitted with oil traps is recommended for the paved parking area. The parking lot pavement should be curbed and graded to direct pavement runoff to the catch basins. The pre-treated discharge from the drainage system would be directed to an underground detention/infiltration system, to promote recharge of groundwater. Overflows from this system would discharge to the stream. Incorporation of a bioswale into the design of the parking lot would be subject to the requirements of removing suspended solids and oil contaminants form pavement runoff prior to its entry into the bioswale.

Construction Sequence/Phasing

This section is intended to discuss a potential phasing strategy and construction sequence necessary to achieve all of the recommended improvements presented in this Master Plan. While the most cost effective method would be to implement a single construction project, that is staged so that certain areas of the site are open to visitors, it is more likely that, based on historical patterns of funding and appropriations, DCR will receive funding for only portions of the projects at a time.

In order to keep the Trailside building, zoological exhibits, and parking for recreational users in operation during construction, the following sequence is suggested (see also Table 4.3 below). These phases are intended to continue public access throughout construction, although parking is reduced to allow one of the parking lots to function as a staging area. Note that is a conceptual discussion, pending further development and refinement of the design and construction project, and will be largely dependent on funding allocations.

In determining the final sequence of construction activity, DCR should also consider the potential affect on the adjacent Blue Hills Ski Area, and minimize closure of the south parking lot during the winter recreation season by scheduling construction work and staging in the south lot for spring and summer. In addition, DCR should work collaboratively with MAS and other zoological exhibit organizations, to prevent adverse affects on the live animal collection, which may require off-site housing for the large mammals during the height of construction.

Pre-construction Phase

- Existing Museum building and outdoor exhibits are operating, both parking lots in use.

Phase 1

The estimated time for completion of Phase 1 construction (new nature education center, partial outdoor exhibits, and staff move into new building) is 12-18 months.

Phase 1A: First construction activity

- Existing Trailside Museum building is operating.
- Existing outdoor collection moves into Animal Care in the existing Museum building or is housed off-site.
- North parking lot is closed and dedicated to construction staging; south lot is open for Trailside visitors / recreation users.

Phase 1B: Move phase

- New building, first set of zoological exhibits and site construction complete (except in areas adjacent to existing museum); existing Museum is closed.
- Staff and equipment move from existing building to new building. Animals move into completed interior and exterior exhibits. Graphics and signage installed.
- North parking lot dedicated to move, south lot is open for recreation users.

Phase 2

The estimated time for completion of Phase 2 construction (building demolition, additional exhibits and site work) is 9 months.

Phase 2A: Second construction activity

- New nature education center building is open and operating;
- Some (River Otter, White-tailed Deer, turtles, etc.) animal exhibits are open;
- North parking lot is re-constructed with new layout then re-opened;

Phase 2B: Demolition activity

- South lot is closed and dedicated to demolition staging.
- Existing museum is demolished.
- Construction phase for second set of new exhibits (raptors, fisher, skunk) is underway;

Phase 3

The estimated time for completion of Phase 3 construction (south parking lot) is 3-6 months.

Phase 3: Third construction activity

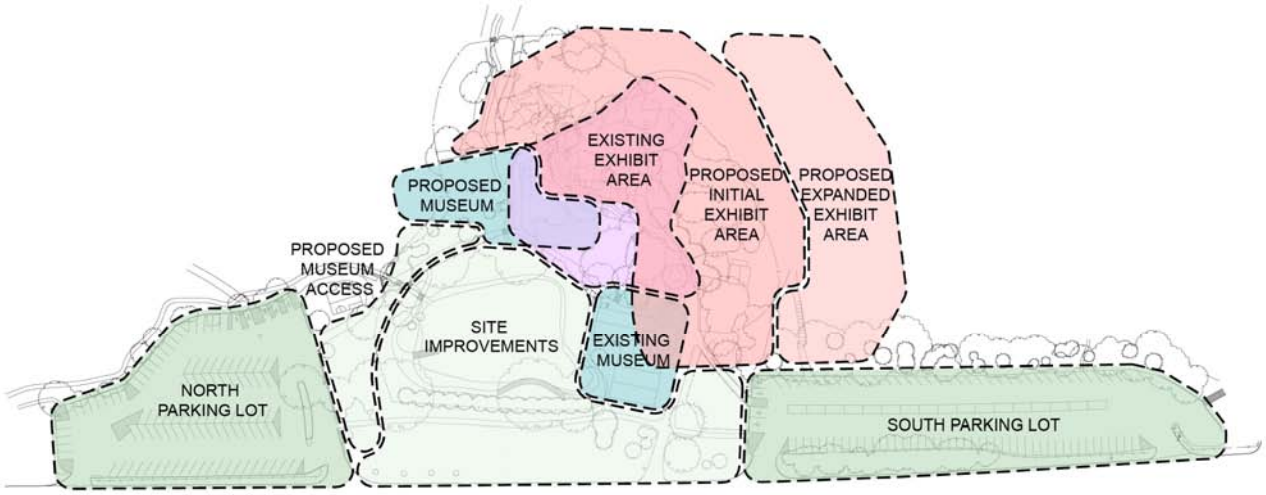
- New nature education center building is open and operating; all initial zoological exhibit areas are open for use.
- North parking lot is completed and open for use; south parking lot is closed and in construction with new parking layout.
- Re-grading, re-vegetation, service access, walks and other new site work at site of former building is constructed.
- At the completion of Phase 3, the nature education center, north and south parking lots, and all trail connections are complete and open for use.

Phase 4

The estimated time for complete of Phase 4 construction (expanded animal exhibits) is 6 months.

Phase 4: Expansion

- South parking lot (or a portion thereof) is closed and used as staging area for exhibit expansion;
- Expanded outdoor exhibits are constructed (bear, coyote, bobcat, etc.)
- South parking lot is re-opened after exhibit construction is complete.
- At the completion of Phase 4, all of Trailside's new facilities are completed and open.



Conceptual locations of construction activity zones; see text above for specific activities during each construction phase (Pressley Associates).

Table 4.3: Summary of Construction Activities and Phase by Area

CONSTRUCTION PHASE	CONSTRUCTION ACTIVITIES BY AREA				
	South Parking Lot	North Parking Lot	Existing Building Site	Proposed Building Site	Zoological Exhibit Area
Pre-construction Phase	Existing and open	Existing and open	Existing and open	Existing condition	Existing and open
PHASE 1					
Phase 1A: First construction activity	Existing and open	Closed – staging area for building construction	Existing and open	New building constructed	Existing animal collection moves into Animal Care area and/or off-site; first group of zoological exhibits constructed.
Phase 1B: Move	Existing and open	Closed – staging for move	Staff and equipment move into new building	New building transitions into operation	Animals move into (eastern) portion of the completed exhibit area
PHASE 2					
Phase 2A: Second construction activity	Existing and open	Closed – New parking layout is constructed	Closed	New building is open	Some exhibit areas open (otter, turtles, deer);
Phase 2B: Demolition	Closed – staging for museum demolition	Open with new layout	Closed	Open	Second group of zoological exhibits constructed (fisher, raptors, etc.). Red Dot Trailhead relocated.
PHASE 3					
Phase 3: Third construction activity	Closed – new parking layout constructed	Open	Service access completed and site revegetated	Open	Open - all animals are in new habitats
PHASE 4					
Phase 4: Exhibit expansion	Staging for zoological exhibits	Open	Partially fenced for exhibit expansion	Open	Primary exhibits are open; expansion area constructed (bear, coyote, bobcat)

Permits and Approvals

Cultural Resources

Current Status

As part of the Blue Hills Reservation, Trailside is included within the boundary of the Blue Hills Multiple Resources Area "Prehistoric and Historic Resources of the Blue Hills and Neponset Reservations and Selected Adjacent Areas," listed on the National Register of Historic Places on September 25, 1980, and within the boundary of the Multiple Property Documentation Form "Metropolitan Park System of Greater Boston," approved August 11, 2003. The Canton Ave. Restroom (1904 Stickney & Austin 'Sanitary') is identified as a contributing resource (building) in both the 1980 and 2003 nomination forms. The 1898 Superintendent's House, which has been altered significantly as a portion of the Trailside Museum, is not discussed in either nomination, presumably because it lacks integrity. In addition to the existing nomination forms, the Massachusetts Historical Commission (MHC) Prehistoric Site Form #19-NF-235 indicates a small artifact recovered along the trail behind the existing Trailside Museum building.

1941 view of the Superintendent's House, before it was modified to become the existing Trailside Museum building (courtesy DCR archives).

MHC Review and Compliance

As a designated historic property, the Blue Hills Reservation is subject to both federal and state regulations and review, depending on the nature of proposed physical changes (undertaking) and the proponent. Any construction project or renovation that requires funding, licenses, or permits from any state or federal agency must be reviewed by the Massachusetts Historical Commission (MHC) for its potential impact to historic properties. In general, the purpose of review and compliance, including both federal and state requirements, is to both identify potentially affected historic properties and adequately plan for physical work so that historic resources are not inadvertently lost or damaged. The *Secretary of the Interior's Standards for the Treatment of Historic Properties* (rev. 1996) are used to assess both appropriate work and affects on historic properties.

Federal Compliance

Section 106 of the 1966 Historic Preservation Act (36 CFR 800) requires that any federal undertakings, including funding, licenses or permits be reviewed for their potential affect on historic properties. In Massachusetts, the State Historic Preservation Officer (SHPO) in the MHC is the primary agency official for consultation, along with other interested parties such as the local historic commission. Section 106 follows a general process that includes identification of historic properties, assessment of effect, and consultation amongst interested parties to avoid, minimize, or mitigate any adverse affects.

If federal Army Corps of Engineers permits and/or U.S. EPA applications are ever required for dredging the pond, or should the DCR desire filling and relocating the existing pond, this action might trigger Section 106 compliance, affecting the schedule and importance of a timely MHC consultation and review.

State Review

Any project that requires funding, licenses, or permits from any state agency must be reviewed by the MHC in compliance with MGL Chapter 9, Sections 16-17C, which provides for MHC review of state projects. This review process follows the same general principles as Section 106 described above, including identification, assessment of effects, and consultation. Since the Blue Hills is a state reservation, with improvements funded by the Department of Conservation and Recreation, MHC review of the proposed project is required. DCR is well acquainted with the MHC review process, and has worked successfully with the MHC on a number of occasions at the Blue Hills Reservation, such as on the universal access improvements for the Canton Ave. Restroom at Trailside.

The MHC also has a role in the Massachusetts Environmental Policy Act (MEPA) process, which directs state agencies to take into account the effects of their actions on the environment, including historic properties.

MHC Review Strategy

For Trailside, the MHC consultation strategy should follow the general three-step process outlined above, including identification, assessment of effect, and consultation. The identification phase, currently underway includes review of historic documents and the National Register nomination(s) to determine the features, materials, and spaces that contribute to the significance of the Reservation and which may be affected by the physical work associated with this project. Fortunately, the presence of the existing nomination forms means that the identification process is both straightforward and nearly complete. However, given the recommendation to demolish (preferred) or re-locate the existing Trailside Museum building, which includes the 1898 Superintendent's House (Visitor Wing), further evaluation may be necessary prior to demolition or relocation. The potential for archeological resources upslope may also require consultation with MHC prior to construction of the new animal enclosures. For the design team, knowledge that the historic Canton Ave. Restroom is a contributing resource to the NR district, is critical to the final design plans.

The assessment of effects is dependent on the physical changes associated with the proposed improvements. As part of their review, MHC should have an opportunity to provide input into the recommended plan to inform subsequent design phases so that the proposed work does not have an adverse effect on the NR district. The first step in the consultation process is to file a Project Notification Form (PNF). The MHC then has 30 days to respond in writing to the PNF to determine whether or not additional consultation is required. This could include 1.) further MHC review, 2.) additional information regarding design or engineering work, 3.) mitigation measures necessary to minimize effects on historic resources.

In addition, MHC reviews all Environmental Notification Forms (ENF) prepared as part of the MEPA process. If an ENF is required, preparation of the PNF should be completed simultaneously to ensure that the two documents are consistent and to expedite review by MHC.

Natural Resource Conservation Regulatory Implications

Wetland Resource Areas associated with Blue Hills Pond include Bordering Vegetated Wetlands (BVW), Bank, and Land Under Water (LUW). The intermittent stream that extends from Blue Hills Pond to the north (along the existing parking lot) is protectable as Bank. These Wetland Resource Areas are protectable under the Massachusetts Wetlands Protection Act (*Act,* M.G.L. c.131, s. 40), its implementing Regulations (*Regulations*, 310 CMR 10.00), the Milton Wetlands Protection Bylaw (Chapter 13), and the federal Clean Water Act. For this site, the *Act, Regulations*, and Bylaw are administered by the Milton Conservation Commission (Commission), while the wetlands protection portions of the federal Clean Water Act are administered by the U.S. Army Corps of Engineers (ACOE). Under the Clean Water Act, these areas are collectively protected as 'waters of the United States.'

Under the *Act, Regulations* and *Bylaw,* a 100-foot Buffer Zone extends from both the BVW and Bank boundaries. Further, the Commission maintains a 25-foot No Disturbance Zone extending from the resource area boundary. Any work within these resource areas and/or the Buffer Zone will require pre-construction review by the Milton Conservation Commission, which is typically achieved by filing a Notice of Intent (NOI) Application or a Request for Determination of Applicability (RDA). Additional state and/or federal permits may be required, depending on the scope of resource area alteration.

The work is also proposed within Estimated and Priority Habitats as determined by the Massachusetts Natural Heritage and Endangered Species Program (NHESP), and will therefore require permitting under the Massachusetts Endangered Species Act (MESA) (M.G.L. c. 131A) and its Regulations (321 CMR 10.00). According to correspondence with NHESP, the site contains estimated habitat for Waxed Sallow Moth (*Chaetaglaea cerata*) and Oak Hairstreak (*Satyrium favonius*) – two species of Special Concern in Massachusetts. MESA review and permitting is typically conducted during the NOI review process and may be conducted under the *Streamlined Massachusetts Endangered Species Act / Wetlands Protection Act Review* process. However, MESA review during NOI review tends to focus on wetland issues, so a broader MESA review or consultation will likely be needed to more fully evaluate the potential effects on the upland invertebrates.[5]

Blue Hills Pond (Pressley Associates 2007).

Wetlands Protection Act and Bylaw

State and Local Permitting Requirements

Based on the proposed Site Plans, work proposed within the Milton Conservation Commission's jurisdiction includes construction of the new building, a proposed service drive, walkways, a boardwalk along the western edge of Blue Hills Pond, and reconfiguration of the north parking lot. This work will require that DCR prepare and submit a Notice of Intent (NOI) Application in order to obtain an Order of Conditions (OOC) allowing the work.

Mitigating Measures

In order to insure protection of the wetland resource areas during and after construction, and to insure compliance with the applicable regulations, the Commission will require that mitigating measures be proposed as part of the project which, at a minimum, will include a comprehensive erosion control program, and compliance with DEP's Stormwater Management Policy. The erosion control program is typically proposed as part of the overall stormwater management program, and comprises of establishing a row of silt fence and hay bales along the Limit of Work boundary. This measure insures that eroded sediments do not enter the wetland during construction, and functions as a visual boundary to insure equipment does not enter the wetland during construction. Compliance with DEP's Stormwater Management Policy will require that Best Management Practices (BMPs) are employed as part of the proposed project to insure that run-off from the site is managed responsibly and according to DEP's standards. These mitigating measures and supporting stormwater calculations are typically designed by the project's civil engineer and are proposed as part of the NOI Application.

Work Within the 25-foot No Disturbance Zone

Portions of the work are proposed within the 25-foot No Disturbance Zone, which specifically includes reconfiguration of the existing northerly parking lot and reconstruction/extension of the boardwalk located along the western edge of Blue Hills Pond. The Bylaw presumes that protection of this No Disturbance Zone is required to adequately protect the existing wetlands on the site. Therefore, preponderance of evidence will be required to demonstrate that the proposed work in this zone will not adversely affect the wetlands. This may be accomplished by comparing the existing condition within the 25-foot No Disturbance Zone to the proposed conditions, and finding ways to improve the function and value the No Disturbance Zone provides for the adjacent BVW and Pond. Such mitigating measures may include native enhancement plantings, invasive species control, wildlife nesting boxes, etc. The interpretive nature of the proposed work in this area, which is intended to foster environmental education and awareness, may also be considered.

Pond Dredging

Based on Baystate Environmental Consultants, Inc. "Watershed Management Plan: Blue Hills Pond, Milton, MA." (October 2006), DCR intends to dredge portions of Blue Hills Pond to improve its water-carrying capacity and function. This work will be located within the wetland resource areas, and will therefore require compliance with the State and local performance standards for work within BVW, Bank, and Land Under Water. At a minimum, restoring the BVW and Bank alteration, conducting a wildlife habitat evaluation, and insuring the replacement of the functions and values of the resource areas will be required. Considering the amount of sediment that has accumulated within the pond, a dredging project – coupled with appropriate resource area restoration could result in positive improvements to the function and value the Pond provides, particularly since this is a man-made pond with an asphalt bottom. The Milton Conservation Commission approved the aforementioned dredging project in March 2008.

Should dredging and/or alteration of these resource areas exceed 5,000 square feet, a 'Category 2' project screening by ACOE will be required, along with DEP's 401 Water Quality Certification. These permit applications are typically submitted, and reviewed concurrently by DEP and ACOE staff. Alteration

beyond the 5,000 square foot threshold may also trigger review under the Massachusetts Environmental Policy Act (MEPA), through the filing of an Environmental Notification Form (ENF) or Environmental Impact Report (EIR), depending on the extent of alteration.

Massachusetts Endangered Species Act and Regulations

The MESA component of the permitting process will require coordination with NHESP. The MESA Regulations protect rare species and their habitat. In order to confirm the project will not result in a "take" of the species, a qualified wildlife biologist will have to conduct a habitat suitability assessment to determine if the species' specific habitat characteristics are present within or near the site. If it is determined that the species' habitat is not present, NHESP may issue a "no take" letter indicating the proposed project (potentially with conditions – know as a "conditional no take") will not result in a taking of the species. If habitat is present, additional, species-specific field investigations may be warranted to determine whether the species is utilizing the site. The information gathered during a species-specific study would also be valuable for developing mitigating measures and/or project design elements that preserve or enhance the rare species habitat. Alternatively, NHESP may determine that maintaining specific setback requirements from the habitat area may provide adequate protection.

Cost Estimate

Table 4.4: Conceptual/preliminary cost estimate for new Trailside facilities, include building, associated site work and interior and exterior exhibits

	Quantity	Unit	Unit Cost		Total
Building					
Site Preparation (tree clearing – lump sum)	1	allow	$ 25,000.00		$ 25,000.00
Demolition (after new construction)	14,578	sf	$ 5.50		$ 80,179.00
Fill in Abandoned Site	1	allow	$ 50,000.00		$ 50,000.00
Utilities-New	1	allow	$ 150,000.00		$ 150,000.00
Ledge Removal Allowance	1	allow	$ 50,000.00		$ 50,000.00
New Construction	21,780	gsf	$ 300.00		$ 6,534,000.00
Building Technology	21,780	gsf	$ 10.00		$ 217,800.00
Building Total					**$ 7,106,979.00**
Site Work					
Vehicular Circulation and Parking	130,577	sf	$ 12.00		$ 1,566,924.00
Pedestrian Circulation	36,908	sf	$ 13.00		$ 479,804.00
Modifications to Trail Access	1	allow	$ 20,000.00		$ 20,000.00
Amphitheater	1	allow	$ 50,000.00		$ 50,000.00
Lawn and Vegetated areas (excluding exhibits)	115,000	sf	$ 10.00		$ 1,150,000.00
Drainage Improvements	1	allow	$ 250,000.00		$ 250,000.00
Site Signage	1	allow	$ 25,000.00		$ 25,000.00
Wetland Boardwalk	1,900	sf	$ 8.00		$ 15,200.00
Site Work Total					**$ 3,556,928.00**

Table 4.4 continued

Exterior Zoological Exhibits (includes initial and expansion area)					
River Otter Site	4,250	sf	$ 250.00		$ 1,062,500.00
Holding	150	sf	$ 150.00		$ 22,500.00
Viewing	320	sf	$ 150.00		$ 48,000.00
Turtles Site	700	sf	$ 50.00		$ 35,000.00
Holding	100	sf	$ 100.00		$ 10,000.00
Virginia Opossum Site	150	sf	$ 100.00		$ 15,000.00
White-tailed Deer Site	12,400	sf	$ 50.00		$ 620,000.00
Holding Barn & Paddock	750	sf	$ 200.00		$ 150,000.00
Barn Owl Site	160	sf	$ 100.00		$ 16,000.00
Red Fox Site	1,800	sf	$ 100.00		$ 180,000.00
Holding	150	sf	$ 150.00		$ 22,500.00
Viewing	128	sf	$ 50.00		$ 6,400.00
Snowy Owl Site	400	sf	$ 100.00		$ 40,000.00
Viewing	128	sf	$ 50.00		$ 6,400.00
Red-tailed Hawk Site	800	sf	$ 100.00		$ 80,000.00
Viewing	128	sf	$ 50.00		$ 6,400.00
Wild Turkey Site	1,800	sf	$ 100.00		$ 180,000.00
Viewing	128	sf	$ 50.00		$ 6,400.00
Turkey Vulture Site	1,800	sf	$ 100.00		$ 180,000.00
Viewing	128	sf	$ 50.00		$ 6,400.00
Fisher Site	800	sf	$ 100.00		$ 80,000.00
Viewing	128	sf	$ 100.00		$ 12,800.00
Striped Skunk Site	200	sf	$ 50.00		$ 10,000.00
Viewing	128	sf	$ 100.00		$ 12,800.00
Snowy Owl / Red-tailed Hawk Holding	100	sf	$ 100.00		$ 10,000.00
Turkey / Turkey Vulture Holding	100	sf	$ 100.00		$ 10,000.00
Fisher / Skunk Holding	264	sf	$ 150.00		$ 39,600.00
Exterior Zoological Exhibits Total					$ 2,868,700.00
Interior Zoological Exhibits					
Timber Rattlesnake	25	sf	$ 200.00		$ 5,000.00
Northern Copperhead	25	sf	$ 200.00		$ 5,000.00
Hot Room	200	sf	$ 100.00		$ 20,000.00
Black Rat Snake	25	sf	$ 200.00		$ 5,000.00
Gray Tree Frog	25	sf	$ 200.00		$ 5,000.00
American Toad	25	sf	$ 200.00		$ 5,000.00
Bullfrog	25	sf	$ 200.00		$ 5,000.00
Interior Zoological Exhibits Total					$ 50,000.00

Table 4.4 continued

Interior Interpretive Exhibits					
Exhibit Hall - permanent exhibits	2,000	sf	$ 500.00		$ 1,000,000.00
Information/Orientation Center	1,500	sf	$ 300.00		$ 450,000.00
Interior Interpretive Exhibits Total					$ 1,450,000.00
Total					$ 15,032,607.00
Total + 15%					$ 17,287,498.00
Notes (Qualifications and Exclusions)					
1. Budgeted values are in 2008 dollars.					
2. Design Consulting Fees are included in added 15%.					
3. Furnishings are not included.					
4. Costs associated with permitting, compliance, and licenses are not included.					
5. Abatement of Hazardous Materials is not included.					
6. Legal Fees and Financing Costs are not included.					
7. Owner's Contingencies are not included.					

Operation, Management, and Permit Agreement

Trailside is operated by the Massachusetts Audubon Society (MAS) under a five (5) year permit from the Commonwealth of Massachusetts, Department of Conservation and Recreation (DCR). In accordance with the current Memorandum of Understanding, the agreement and services shall be from July 1, 2007 to June 30, 2012. Per the terms of the MOU, both Trailside and the Chickatawbut Environmental Education Center will be operated "for the purpose of Reservation interpreting for visitors of the general public."

MAS is to provide a permanent live animal collection with veterinary services as well as staff to operate a program of exhibits, disseminate information, and provide environmental education programs. MAS is responsible for keeping the interior and exterior of the Trailside Museum building in a clean, neat and orderly condition and operate the Canton Ave. Restroom to best of their ability. MAS assists with the supervision of repairs and construction, but are not responsible for these activities. MAS is expected to perform minor routine preventative maintenance and minor repairs, and make minor improvements to the facilities that enhance services to the public as determined jointly with DCR. Admissions fees to the interior of the Museum must go toward the exclusive benefit of Trailside.

DCR is responsible for maintaining the buildings and facilities in good condition, including maintenance and repairs. DCR furnishes Trailside with light, heat, power, and water as well as janitorial and maintenance supplies and materials. According to the terms of the agreement, DCR will also make equipment available for use at Trailside. During the winter, DCR keeps all parking lots and driveways clear of snow and ice.

The Commonwealth has provided a subsidy of approximately $425,000 appropriated by the Legislature for Trailside, but this appropriation is subject to economic conditions and in FY09, the amount was reduced to $125,000. MAS current cost of operations is approximately $600,000. Both MAS and DCR Blue Hills District contribute services toward the maintenance of the site and buildings, but current operational and capital funds are not sufficient to support the facility's maintenance, management, staffing and programmatic needs.

While the annual appropriation is absolutely essential to MAS operation at Trailside, the structure of the existing 5-year permit agreement does not provide sufficient long-term security to stabilize operations, allow for long-term planning, or encourage

investment. Both DCR and MAS recognize that the future of Trailside must include a critical look at the permit structure and funding for Trailside by both organizations. There is considerable concern amongst both parties that a longer term agreement, such as the Massachusetts Horticultural Society lease at Elm Bank, may lead to the loss of Trailside's operational funding. Therefore, it may be prudent for both organizations to work collaboratively with their legislative delegation to formulate a management strategy for Trailside that provides the long-term stability needed to achieve the objectives of this Master Plan.

It is likely that MAS will require substantial improvements to the existing facility before they would consider a long-term lease at Trailside. Furthermore, given the educational potential for the new Trailside facilities and the cost of improvements outlined above, a new management structure should be in place before the new building is fully funded and slated for construction. The process for establishing a long-term lease does complicate the future of Trailside, as the long-term leases are issued through the Department of Capital Assets Management (DCAM) in consultation with DCR, and are required to be open solicitations.

It is also essential that the existing permits for the Blue Hills Ski Area and Blue Hill Observatory be reviewed in the context of Trailside's operation, to ensure that joint use and responsibilities are clearly defined, particularly with respect to parking area use and trailheads, with performance criteria for maintenance and operation during ski season cleared defined. The 2008 Legislative session granted permission for DCR to advertise and enter into 25-year leases for the Blue Hills Ski Area and the Blue Hill Observatory.

Maintenance

Site

While a substantial capital investment will be required to upgrade the Trailside site to meet its resource management, education and public use potential, additional resources will be required to develop long-term stewardship of the improvements and to develop an efficient maintenance program to protect the capital investment. Preservation and enhancement of the natural resources of the site should always be a prime consideration, along with visitor access and safety, and the protection of the zoological collection. Site maintenance is shared between the DCR and MAS; as plans for the new nature education center building and site improvements progress, increased maintenance capability may be required. Specific considerations for site features are listed below.

Vegetation

The forested upland, vegetated wetland, meadow, shade trees, and small areas of lawn are essential qualities of the Trailside landscape. Vegetation in public landscapes can be subject to intensive visitor use, and may be subject to soil compaction, soil erosion, loss of groundcover or other herbaceous material, exotic invasive species may self-seed into the edges of ponds or shub areas, and older trees can no longer compete for nutrients and water and begin to decline. The following maintenance activities are recommended:

Lawn

- Determine frequency and implement mowing based on desired affect and site conditions (such as tree canopy); collect litter prior to mowing;
- Inspect lawn areas in spring and correct erosion; inspect lawn areas in fall and re-seed bare areas;
- Control weeds and pests using environmentally safe methods.
- Meadow areas may be mowed in later summer or fall after native species have gone to seed and danger of disturbing ground-nesting birds has passed.

New woody plants

- The annual maintenance program for trees and shrubs will depend on the type of plant material introduced into the site and the skill level of the maintenance personnel.
- Hand pruning is always preferred in order to maintain the natural character of the plant species.

Arboriculture

- Yearly inspect canopy trees adjacent to public visitor areas and remove hazardous limbs when needed.
- Annually inspect and monitor Wooly Aldelgid infestations (Hemlocks) and other pest problems and treat where applicable following Integrated Pest Management (IPM) practices.

Invasive species management

- A yearly inspection of invasive species should be conducted, with a special emphasis on the wetland

vegetation. If control measures are needed, they must be designed for the specific species to be removed, and minimize disturbance of the wetland.

Pavement and paths

Snow removal

- Only hard surface paving should be plowed. Use environmentally safe deicer for sidewalks, paths and adjacent steps. All soft surface materials shall not be plowed.

Surfaces

- Inspect all paving surfaces yearly and repair or replace as required.

New steps and path in outdoor exhibit area (Pressley Associates, 2008).

Trash removal

- The landscape should be clean and free of trash and litter.
- Trash receptacles should not be overflowing and litter should be kept to a minimum.

Building

Recommendations for long-term maintenance of the building facility:

Regular cleaning and maintenance

- Clean building surfaces most prone to soiling, for appearance, safety and to minimize damage resulting from accumulated grit or debris:
  - Floor washing and vacuuming (weekly)
  - Window washing (twice annually)
- Periodic refinishing, repair or replacement: Renew finishes or coatings on building surfaces to maintain attractive appearance and prevent damage from wear or weathering:
  - Strip and reseal resilient, concrete or stone floors: Two years
  - Painted interior partitions and ceilings: Ten years
  - Painted exhibit area walls: Two years or at new exhibit installation
  - Exterior painted elements: Ten years
  - Carpet: Ten to twenty years
  - Acoustical ceilings: Ten to twenty years
- Replacement or upgrading of systems under long-term warranty: These building components will have warranties that run from the completion of construction. Plan to replace these systems at end of warranty period.
  - Roof system: Twenty years
  - Exterior sealants: Ten years
- Service contracts: Engage outside vendors to monitor system operation, perform repair work as needed, and recommend upgrades for performance or for compliance with applicable regulations:
  - Elevator
  - Fire suppression system (sprinklers)
  - HVAC controls and equipment
  - Fire alarm system

Zoological Exhibits

Exhibit Maintenance

- Enrich habitats for each species based on a developed ‘Enrichment Plan”.
- Re-setting perches and props in each exhibit would be considered routine maintenance.
- Nest-boxes or shelters may need to be fabricated;
- Exhibit features may need to be changed on a yearly basis to improve well-being for the inhabitants.

Water-systems maintenance

- Monthly or semi-annually, backwash of filters and cleaning of pump and sanitizing equipment.
- Equipment should be upgraded as necessary to provide most efficient water cleaning system.

Mesh Structures

- Care must be taken to maintain the steel mesh structure containment for the animals by removing leaf, branches and other materials for building-up on roofs.
- Turnbuckles should be oiled and maintained on a regular cycle.
- Daily inspection is necessary to confirm the enclosure is free of rips, openings or sharp objects.

Animal Holding

- Daily cleaning, removal of bedding, restocking of foods and hay, and waste removal are part of the animal care staffs routine.
- Additional maintenance will be necessary to remove rust on metal fabrications and maintaining all doors or windows for smooth operation.
- Lighting and equipment service as necessary.

Site Structures

- Semi-annually inspect all wooden site features including, viewing blinds, fences, view-rails, graphic panels to determine necessary maintenance.

New Name

DCR and MAS concur that Trailside would benefit from a new name, removing “museum” from the title and replacing it with something else that more clearly defines the building and site as a nature education facility. While a decision has not been reached, samples of existing facility names and logos are included as Appendix G to help guide future discussion.

Additional Ideas Considered

DCR, MAS and the project team had extensive discussions about potential additional amenities at Trailside, some of which were also suggested by the Trailside Advisory Committee. Although these ideas were not included in the final plans, they deserve mention, and might be considered in the future as the design progresses. They include:

- Flight demonstration area: while there is high interest in an active outdoor venue for flight demonstrations, concern over liability issues precluded including this feature in the plan.
- Walk-though aviary: this feature could showcase a broad assortment of woodland and songbirds; as above, the walk-through component presented liability issues.
- Butterfly exhibit: since invertebrates are under-represented at Trailside, an indoor butterfly exhibit could enhance the exhibit program, even though they exist nearby (e.g. Norwood, Museum of Science).
- Night in the Reservation exhibit: this could be considered at a later date as the exhibit design is developed and would cover the sound, sights, and creatures of the night, since most visitors will never spend a night out in the Reservation. Squam Lake has a small night time exhibit.
- Ant farm: this could be incorporated into the free exhibit area in the Orientation Center, to enhance Trailside’s invertebrate exhibits.
- Café: both indoor and outdoor food concessions were discussed during the planning phase, but they presented too great a need for additional staffing for a small financial return.
- Fireplace or fire ring: an indoor fireplace was suggested in the Gift Shop but was not included and might be more appropriate indoors in the Orientation Center; in addition, an outdoor fire ring could be considered in the future, particularly related to the Amphitheater, which is a gathering area for outdoor programs presented by both MAS and DCR.

Recommendations for Further Study

This Master Plan is the first step in securing a new future for the buildings, site, and exhibits associated with Trailside. It is also only one piece of a very active part of the Blue Hills Reservation, which contains three overlapping uses each governed by short-term permit agreements. For these reasons, the consultant team recommends a series of additional studies or actions needed to ensure that DCR and MAS achieve the objectives outlined in this Master Plan.

- Explore the potential to rename Trailside, eliminating "Museum" from the name, and replacing it with something more suited to the mission of Trailside (such as Nature Center.)
- Complete additional site survey to document site improvements implemented 2007-08 and the expanded exterior exhibit program. The additional survey should be completed in a format that can be manipulated in 3D.
- Building on the Trailside Master Plan, undertake a coordinated planning initiative for the three permitted uses at Great Blue Hill (Ski Area and Observatory) to ensure that future plans are coordinated.
- Prepare Schematic Design and Design Development for Trailside, including the new building, site improvements, zoological exhibits, and interior educational exhibits.
- Complete a Strategic Funding Plan focused both on capital improvement funds needed to achieve this Master Plan, but also to address long-term operational stability and funding, including annual appropriations to DCR, MAS contributions, grants and philanthropy.
- Prepare a birds-eye aerial perspective of the proposed site improvements, including the new nature education center building and outdoor exhibits, which could be used as a component of a capital campaign or for visitor education, to help communicate the future vision for Trailside.
- Commission a Traffic Study for Trailside. Given the fact that Canton Avenue is a state route, any changes, such as the proposed dedicated left turn lane, require substantial input, review and implementation by Massachusetts Highway Department. A traffic study, with counts during peak traffic and public use period, is needed to determine if a dedicated left-turn lane is really feasible.
- Conduct a historic evaluation of Superintendent's House and consultation with MHC prior to demolition or relocation.
- Explore the requirements, benefits, and drawbacks of AZA accreditation, even though Trailside is not a zoo, in order to better serve the live animals housed at Trailside and provide enhanced interpretation.
- Re-evaluate the MAS policy regarding captive breeding of native species prior to initiating design for future zoological exhibits.

Endnotes

[1] Lynx has also been considered for future exhibit expansion, but since it has not been historically documented in the Blue Hills, it was eliminated from the expansion species list.

[2] Note that the White-tailed Deer enclosure includes a large fenced area with vegetated buffer with a smaller area bordered by hot-wire.

[3] Current MAS policy does not allow for captive breeding of native animal species. However, general husbandry standards for River Otter encourage multiple animals such as a family group.

[4] As MAS policy above.

[5] DCR Resource Management Program communication.